"COMPARATIVE STUDY OF EFFICIENCY OF VARIOUS ORAL HYGIENE MEASURES ON HALITOSIS AND ITS CAUSATIVE ORGANISMS IN FIXED APPLIANCE THERAPY PATIENTS"

Dissertation Submitted to

THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY

For partial fulfilment of the requirements for the degree of

MASTER OF DENTAL SURGERY

BRANCH – V

ORTHODONTICS AND DENTOFACIAL ORTHOPAEDICS

THE TAMILNADU DR. M.G.R MEDICAL UNIVERSITY
CHENNAI – 600 032

2016 – 2019

CERTIFICATE

This is to certify that **Dr. ARUN NARAYANAN,** Postgraduate student (2016-2019), in the Department of Orthodontics and Dentofacial Orthopedics (branch V), Tamil Nadu Government Dental College and Hospital, Chennai-600 003, has done this dissertation titled **"COMPARATIVE STUDY OF EFFICIENCY OF VARIOUS ORAL HYGIENE MEASURES ON HALITOSIS AND ITS CAUSATIVE ORGANISMS IN FIXED APPLIANCE THERAPY PATIENTS"** under my direct guidance and supervision for partial fulfilment of the M.D.S. degree examination in May 2019 as per the regulations laid down by The **Tamil Nadu Dr. MGR Medical University,Chennai-600032** for **M.D.S Orthodontics and Dentofacial Orthopaedics (branch V)** degree examination.

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DECLARATION

I, **Dr. ARUN NARAYANAN** , do hereby declare that the dissertation titled **"comparative study of efficiency of various oral hygiene measures on halitosis and its causative organisms in fixed appliance therapy patients"** was done in the Department of Orthodontics, Tamil Nadu Government Dental College & Hospital, Chennai 600 003. I have utilized the facilities provided in the Government Dental College for the study in partial fulfilment of the requirements for the degree of Master of Dental Surgery in the specialty of Orthodontics and Dentofacial Orthopaedics (Branch V) during the course period **2016-2019** under the conceptualization and guidance of my dissertation guide, **Professor Dr. G.Vimala, M.D.S.**

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ACKNOWLEDGEMENT

I am eternally grateful to the Omniscient Being for bestowing wonderful parents, my wife Dr DhivyaBharathi , my son A Harshavardhan and my brother who constantly encouraged me in this endeavour to achieve my dream.

I express my sincerest gratitude to my benevolent teacher and guide **Dr. G.VIMALA, M.D.S., Professor and HOD**, Department of Orthodontics and Dentofacial Orthopaedics, Tamilnadu Govt. Dental College and Hospital, Chennai-3, for her ingenuity, immense support and encouragement

.

I consider it a great honour to thank my respected **Professor Dr. Sridhar premkumar M.D.S.,** Department of Orthodontics and Dentofacial Orthopaedics, Tamilnadu Govt. Dental College and Hospital, Chennai-3, for his encouragement throughout the study and the entire course.

I am also thankful to respected **Professor Dr.B.BALASHANMUGAM , M.D.S.**, Department of Orthodontics and Dentofacial Orthopaedics, Tamilnadu Govt. Dental College and Hospital, Chennai-3, for his valuable and timely suggestions and encouragement.

I sincerely thank Associate Professors **Dr. G. Usha Rao, Dr. M. Vijjaykanth, Dr. M. D. Sofitha** and Assistant professors **Dr. M.S. Jayanthi, Dr. K. Usha, Dr. D. Nagarajan, Dr. Mohammed Iqbal, Dr. R. Selvarani ,Dr.Geethalakshmi ,** for their continuous support and encouragement

I sincerely thank **Dr.R.Selvi MD** , Professor &HOD, Department of microbiology ,Government Stnley medical college and **Dr. K. Chandrasekaran,MD**, Assistant professor , Department of microbiology ,Government Stnley medical college for their support and guidance .

I thank **Dr. Dippayan Datta** M.D.S, for helping me in statistical analysis. I thank my fellow postgraduates for their support.

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This agreement herein after the "Agreement" is entered into on this 11th day of February 2019 between the Tamil Nadu Government Dental College and Hospital represented by its **Principal** having address at Tamil Nadu Government Dental College and Hospital, Chennai-03, (hereafter referred to as, "the college")

And

Dr. G.Vimala aged 50 years. (Herein after referred to as the 'co- investigator)

And

Dr. ARUN NARAYANAN aged 33 years currently studying as postgraduate student in department of Orthodontics in Tamil Nadu Government Dental College and Hospital (Herein after referred to as the "PG/Research student and Principal investigator").

Whereas the, PG/Research student as part of his curriculum undertakes to research **"comparative study of efficiency of various oral hygiene measures on halitosis and its causative organisms in fixed appliance therapy patients"** for which purpose the co-investigator and the college shall provide the requisite infrastructure based on availability and also provide facility to the PG/Research student as to the extent possible as a Principal investigator.

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1.
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Comparative study of efficiency of various oral hygiene measures on halitosis and its causative organisms in fixed appliance therapy patients

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Date of review: 13.11.17

Date of previous review, if revised application: Not Applicable

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CFU	Colony forming units
GCF	Gingival crevicular fluid
GI	Gingival Index
PI	Plaque Index
VSC	Volatile sulphur compounds

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INTRODUCTION

INTRODUCTION

"Comparative study of efficiency of various oral hygiene measures on halitosis and its causative organisms in fixed appliance therapy patients."

Halitosis is a lyrical term derived from the Latin word halitus,meaning breath and the Greek suffix osis, meaning condition, action of a pathologic process.

Halitosis denotes the offensive smell of breath. The consequences of halitosis can be more than social; its presence could reflect serious local or systemic conditions. Synonyms for bad breath are foetor ex ore, oral malodour or offensive breath.

In 90% of patients with bad breath, mouth is the main source.

Halitosis is caused by several intraoral and extraoral factors, including systemic diseases and disorders of the gastrointestinal or upper respiratory tracts, otorhinolaryngological changes, specifically upper respiratory tract infections, use of certain medications, consumption of tobacco and particular dietary habits .

Halitosis mainly originates from volatile sulfide compounds (VSCs), especially hydrogen sulfide, methylmercaptan, and dimethyl sulfide produced during breakdown of food particles by micro organisms, as first discovered by Tonzetich.

Various studies show that 85–90% of all cases exhibit bacterial decomposition of organic material in the oral cavity as a cause for halitosis (Amir et al. 1999, Delanghe et al. 1996, Delanghe et al. 1997, Delanghe et al. 1999, Rosenberg & Leib 1997)

Oral halitosis has been associated with both gingivitis and periodontitis, however, it can also be present in periodontal disease free individuals (Bosy et al. 1994)

Factors favoring halitosis are tongue coating, periodontal diseases, large cavities with open root canals, pericoronitis, conditions affecting the oral mucous membrane, food impaction, neglected dentures, reduced salivation, and oral breathing.

Moreover, many researchers like Atack, N.E et al have observed inflammation of gingival tissues during fixed orthodontic therapy [1]. This condition has been related to hampering of oral-hygiene measures by fixed orthodontic appliances with consequent increases in the accumulation of bacterial plaque. In addition , Food impaction is common during fixed orthodontic treatment. [50]

Fixed orthodontic appliances also favour the accumulation of plaque (Mitchell 1992). The design and surface structure of fixed orthodontic appliance, as well as the adhesives composite resin favour plaque retention (Gwinnett & Ceen 1979). In fixed appliances, orthodontic bands are a major cause of gingiva inflammation (Huser et al., 1990)

Plaque accumulates particularly beneath bands from which some cement has been washed out adjacent to adhesive retention elements (Gwinnett & Cheen, 1979; Mizrahi, 1982). Plaque is found predominantly cervical to brackets under the arch wires. The scores of different

periodontal parameters (Plaque Index, Gingival Bleeding Index) and proportion of spirochetes were found higher for banded molars than for molars with brackets/bonded buccal tubes (Boyd & Baumrind, 1992; Freundorfer et al. 1993). The elements of fixed orthodontic appliance can change the biologic balance in the oral cavity. In these situations gram negative and anaerobic microrganisms (Porphyromonas gingivalis, Prevotella intermedia, Actinomyces) are disproportionally present along the subgingival band margins (Diamanti-Kpioti et al., 1987), and there is an increased number of spirochetes, mobile rods and fusiform organisms.

The oral microbes most likely to cause the oral malodour are Gram negative bacteria and include Prevotella (Bacteroides) melaninogenica, Treponema denticola, Porphyromonas gingivalis, Porphyromonas endodontalis, Prevotella intermedia, Bacteroides loescheii, Enterobacteriaceae, Tannerella forsythensis (Bacteroides forsythus), Centipeda periodontii, Eikenella corrodens, Fusobacterium nucleatum vincentii, Fusobacterium nucleatum nucleatum, Fusobacterium nucleatum polymorphum, and Fusobacterium periodonticum.[1,34]

Relation between orthodontic appliances, specifically fixed appliances, and halitosis has been less explored. An exception is the study by Babacan et al. (2011), which found a causal relationship by halimeter measurements and plaque and gingival indices.[20]

Microbial count increases and gingival and periodontal status deteriorates during the orthodontic (Nikkie .E.Atack 1996) treatment . In addition the VSC producing organisms

cause halitosis which increases during the course of the treatment (Babacan et al 2011). In order to prevent halitosis in orthodontic patients and to improve gingival and periodontal health during fixed orthodontic treatment, reduction of oral microbial count is indicated. Mouth rinses are one of the adjuncts used often for this purpose.

Since fixed orthodontic therapy is usually carried out for nearly 18 to 24 months , it becomes a necessity to identify a cost effective mouth rinse that can be used for such long period of time without side effects.

Chlorhexidine mouth rinse is used as a positive control and is considered a gold standard.[23] However, various side effects of chlorhexidine on long time use, like Staining of teeth, Allergy, Altered taste sensation, Stomatitis and Reduction in natural resistance to viral infections, due to precipitation of mucins, discourage its use in orthodontic patients [leiv flotra, per gjermo (1971) ahmad mogharehabed (2016)]

Oil pulling, an indigenous, cost effective method of mouth rinse is recently gaining popularity. Oil pulling is an alternate oral hygiene measure that has proved effective in non orthodontic patients in controlling halitosis with no side effects.Studies conducted on oil pulling have concluded that oil pulling is equally efficient as chlorhexidine mouthwash as an oral hygiene adjunct with many advantages (Poonam sood .et .al,(2014) Sharath Asokan .et.al.(2011)).

The quoted advantages of oil pulling includes: Easy availablility, Palatable taste, Less irritating, Cost effective, Less side effects, Possibility of prolonged usage , No discolouration of teeth,

Boosting of Immunity (Thaweboon et al., (2011), Ashokan et al. 2011, Durai et al., (2008)[3,14,51]

Similarly, normal saline is also a cost effective mouth rinse that is in use [64]

In the study by Aravinth v et.al, [64], it was found that 0.8 M salt water is effective against reducing dental plaque and the salivary oral microbial count. Their mechanism of action probably is due to the fact that at high concentration of salt solution, the solute concentration in the surrounding solution is greater than the cytoplasm of oral bacteria. Water moves out from cell by osmosis. Oral bacteria becomes dehydrated and eventually dies .[37]

Therefore this study was done to find the most effective, cost efficient, easily accesible and readily acceptable mouthwash for fixed appliance patients. Hence this study was undertaken to find the effeciacy of oil pulling and normal saline mouth rinses, upon comparision with Chlorhexidine which is the gold standard so far , by assessing gingival heath, finding reduction of oral microbial flora and reduction in halitosis.

AIMS AND OBJECTIVES

AIM

To compare the efficacy of various oral hygiene measures on halitosis and its effect on the causative organisms in fixed appliance patients.

OBJECTIVES

- To analyse the effect of the oral hygiene measures on gingival and periodontal health if the orthodontic patient
- To analyse the effect of oral hygiene methods on the breath scores by both organoleptic method and using a breath analyser
- To measure the effect of oral hygiene measures on the total anaerobic bacterial count in orthodontic patients

REVIEW OF LITERATURE

REVIEW OF LITERATURE

VARIOUS STUDIES STATING THAT FIXED APPLIANCE ENHANCES PLAQUE ACCUMULATION

1. **Zachrisson S (1972)** [52] in his study states that that gingival condition worsened with in one or two months of fixed appliance placement and Periodontal condition worsened in posterior segment more and in interproximal areas. He concludes that this condition resolved once appliance were removed.

2. **Kloehn JS (1974)** [26]**,** also confirms that there is a direct relation between orthodontic health and health of periodontium. The health of the periodontium worsened in the presence of orthodontic appliances. He also states that hyperplastic and inflammatory changes in gingiva were reversible and periodontium health improved after orthodontic treatment.

3. **Trossello VK and Gianelly AA(1979)** [56] did a study on Orthodontic treatment and its effect on periodontal status and in this study he suggests that the effects of orthodontic treatment on the periodontium, are small. lower incidence of mucogingival defects and the more amounts of interradicular bone, seems beneficial. Others, such as the high incidence of tooth résorption, and tissue hyperplasia in the maxillary molar region suggesting increased pocket depth, and the slight loss of alveolar bone noted in the orthodontically treated patients, can be harmful. the net effect is relatively modest .

4. **Gwinnett A J and ceen R F (1979)** [17] in his scanning microscope study on Plaque distribution on bonded brackets found that the surface area of resin is a most important factor in the accumulation of plaque, in addition to the size (coarseness) of particles in the resin and the type of bracket used.

5. **Alexander S A (1991)** [6] did a study on effects of orthodontic attachments on the gingival health of permanent second molars and found that orthodontic attachments causes a moderate gingivitis irrespective of cementation or enamel bonding to second molars. The levels of inflammation were lower with the bonded appliances. He also suggests that once these appliances are removed, the gingival condition resolves.

6. **Davies TM (1991)** [12] in his study on the effects of orthodontic treatment on plaque and gingivitis indicates that there were differences with respect to plaque accumulation and gingivitis at the baseline examinations between children who were receiving orthodontic treatment and those not receiving.

7. **L. MITCHELL et al (1992)** [29] in his study regarding the decalcification of teeth during orthodontic treatment emphasises that fixed appliances hinder teeth cleaning, and favours plaque accumulation and food retention. He also found an increase in count of Streptococcus mutans and lactobacilli following the use of orthodontic appliances.

8. **Boyd R L and Baumrind S (1992)** [7] studied the Periodontal considerations in the use of bonds and bands on molars in adolescents and adults and determined that more plaque accumulation and gingival inflammation occurred in interproximal sites of banded molars and Greater interproximal loss of attachment happened in banded molars. Regarding the plaque accumulation he found that higher mean value of plaque accumulation and gingival inflammation is seen in interproximal areas of adoloscents than adults.

9. **Atack NE (1996)** [1] in a study conducted by him noted that soon after band placement there is a shift in the subgingival microflora to a periopathogenic population with increases in anaerobic rods, like Prevotella and Bacteroides species, fusiform bacteria, and spirochetes

10. **Ristic M (2008)** [44] also in his study on effects of fixed orthodontic appliances on subgingival microflora substantiates that fixed appliances transitionally increases the growth of pathogenic bacteria and hence result in gingival inflammatory response but with respect to the effect on periodontal tissue not much of destuction happened in deep periodontal tissues

STUDIES CORRELATING MICROORGANISMS AND HALITOSIS

11. **J.Tonzetich ,V.J.Richter (1964)** [60] evaluated the volatile odoriferous components of saliva with the objective to elucidate chemical reactions involved in odour production, to characterize the odour components, and to establish suitable chemical methods for the determination of odour intensity of saliva.

    The initial objective of this study was to find whether a relationship exists between the chemically determined Volatile reducing substance (VRS) values and organoleptic ratings(OR) . A comparison of the two methods was made on saliva samples that have been subjected from 1 to 50 hr of incubation at 37°C .The results indicated that a relationship exists between the OR and VRS content of putrefied saliva.

12. **Tonzetich J (1969)** [57] studied the role of human salivary fractions and plaque on Odour production and found that plaque had a strong potential for odour production in the presence of appropriate substrates.The evidence derived from these studies suggests that plaque and saliva elaborate similar malodorous products of putrefaction.

13. **WALTER J. LOESCHE(1969)** [61] studied oxygen Sensitivity of Various Anaerobic Bacteria and recognized two patterns of organisms included in study.They were Strict anaerobes- species incapable of agar surface growth at P02 levels greater than 0.5 %.

    Moderate anaerobes-species capable of growth in the presence of oxygen levels as high as 2 to 8%.

    The results showed that certain anaerobic bacteria varied in regard to their ability to grow on agar surfaces in the presence of molecular oxygen. This meant that isolation

techniques employing continuous anaerobiosis, i.e., roll tube or anaerobic chambers, would permit cultivation of all anaerobes whose nutrient requirements are met by the medium employed, whereas anaerobic jar techniques, depending on the length of atmospheric exposure, would probably discriminate against strict anaerobes and only allow growth of less oxygensensitive anaerobes.

14. **McNamara TF and Alexander JF (1972)** [30]studied the role of microorganisms in production of oral malorder and confirmed the findings of previous investigations that bacteria are essential to the production of intrinsic oral malodor. The Gram-negative microorganisms were identified as those chiefly responsible for the production of intrinsic oral malodor. Saliva incubated (stagnate) resulted in a shift in the ratio of gram-positive to gram-negative organisms and favors the growth of the latter . They found that slightly alkaline pH (7.2) favors malodor production, while a slightly acid pH (6.5) has the opposite effect.

15. **Salam A. Syed(1972)** [51] studied the Survival of Human Dental Plaque Flora in Various Transport Media. In his study dental plaque samples from (i) subjects with no apparent oral disease, (ii) mentally retarded subjects with periodontal disease, and (iii) subjects with active caries were collected in three transport media viz. a dithiothreitol poised balanced mineral salt solution designated as reduced transport fluid (RTF), VMG II, and modified Stuart medium (SBL). The samples were dispersed by sonic treatment, diluted in the respective medium in which they were collected, and cultured on MM10 sucrose agar. The efficiency of the transport media in the survival of dental plaque flora were determined by comparing the quantitative recovery.

In this study , a balanced mineral salt solution (4) poised with dithiothreitol (DTT), and containing sodium ethylenediaminetetraacetate (EDTA) was evaluated for its

usefulness as a transport medium for various oral bacterial specimens. The efficiency of this transport medium, designated as reduced transport fluid (RTF), was compared with that of VMG II and SBL media in maintaining the viability of bacterial flora present in the samples

There was approximately a 19% reduction in the viable counts after 6 hr of storage of the specimens in RTF. The VMG II and SBL showed a slight increase in the recovery of the organisms, indicating possible multiplication. Approximately 70% of the organisms were destroyed after 1 day of storage in RTF as compared to 28 to 30% loss in viability in VMG II and SBL medium under identical conditions

16. **Tonzetich J. (1977)** [58] reviewed the mechanisms of production and origin of oral malodor and methods of their analysis and concluded that hydrogen sulphide and methyl mercaptan emanate an offensive putrid odor and account for approximately 90 % of the total sulphur content of mouth air. He also found that In half of the population tested, methyl mercaptan and hydrogen sulphide content of early morning mouth air is sufficiently high to account for the oral malodor.

    His study also indicated that both plaque and tongue are important sources of malodor with most of the odor emanating from the dorso-posterior surface of the tongue .

17. **Persson S, (1989)** [41] studied the capacity of subgingival microbiotas to produce volatile sulfur compounds in human serum . Bacterial samples from nine deep periodontal pockets were incubated for 7 days in human serum and the amounts of volatile sulfur compounds and the degradation of serum proteins were determined. Hydrogen sulfide was the predominant volatile sulfur compound.Hydrogen sulfide is formed by the subgingival microbiotas of periodontal pockets. methyl mercaptan was formed in significant amounts. Only traces of dimethyl sulfide and dimethyl disulfide were detected. There was an extensive degradation of the serum proteins. In most of the reaction mixtures hydrogen sulfide reached highly toxic levels

18. **Yaegaki K (1992)** [62] examined Volatile sulfur compounds in mouth air from clinically healthy subjects and patients with periodontal disease and found that saliva does not contribute to the elevated ratio of methyl mercaptan in mouth air. These results strongly suggest that, in addition to periodontal pockets, tongue coating has an important role in VSC production, in particular leading to an elevated concentration of methyl mercaptan, which is more pathogenic than hydrogen sulfide

19. **Coli JM ,and Tonzetich J. (1992)** [11] studied the Characterization of volatile sulphur compounds production at individual gingival crevicular sites in humans and described a method for collection and analysis of volatile sulphur compounds (VSC) from gingival crevicular sites in humans. Tenax-GC trapping devices were used to adsorb and concentrate VSC from crevicular air at -55 degrees C, which were then thermally desorbed at 120 degrees C.

20. **De Boever EH (1995)** [13]Assessed the contribution of anaerobic microflora of the tongue to oral malodor and found that the proteolytic, anaerobic bacterial flora on the tongue plays an important role in the development of halitosis.

21. **Scully C and El-Maaytah M (1997)** [46] assessed the etiopathogenesis and management of Breath odor and found that malordor arises from the lingual or periodontal flora and gram-negative anaerobes being the main organisms capable of releasing sulphur compounds, from the putrefaction of debris and other material. Volatile sulphur compounds, cadaverine and other substances appeared responsible for much of the malodor. Systemic disease also contributed to some cases of oral malodor.

22. **I. Kleinberg, and G. Westbay (1999)** [22] in his study found that in healthy individuals, freshly collected whole saliva usually has a pleasant smell. However, upon incubation, the saliva becomes progressively alkaline and acquires a putrid odor

    Tonzetich also found that the odorous components present in mouth air were basically the same as those found in the head space of incubated whole saliva from the same individuals

    Eggers-Lura measured the PO2 of unstimulated and stimulated saliva and found the PO2 of the stimulated saliva to be about 40 to 75 mmHg, while unstimulated saliva was approximately 20% lower.

    McNamara et al. found that Gram negative rather than Gram-positive bacteria of the salivary flora were responsible for malodor formation.

23. **Paryavi-Gholami F, (1999)** [39] investigated the microbiological cause of oral malodor in children and volatile sulfur compound in saliva. They examined and compared levels of salivary bacteria which produced volatile sulfur compounds (VSC) in young children with and without oral malodor

Clinic populations of children aged two to seven years, whose parents presented with an unsolicited major complaint of oral malodor in their child , or aged-matched controls in whom oral malodor was not detected by parents , were investigated.

Saliva specimens were cultured anaerobically on media that differentiated VSC+ bacteria

A primary objective of this investigation was to quantify and characterize predominant odor forming bacteria in saliva of young children and the results were

1) Veillonella species and Prevotella oralis were the predominant VSC+ isolates recovered
2) Levels of P. oralis were significantly higher in OM+ versus OM- children

24. **Yaegaki K (2000)** [63] in his clinical perspectives on Examination, classification, and treatment of halitosis recommends that management of halitosis includes periodontal or restorative treatment or both, as well as simple treatment measures such as instruction in oral hygiene, tongue cleaning and mouth rinsing. He finds that Psychosomatic halitosis is more difficult to diagnose and manage, and patients with this condition are often mismanaged in that they receive only treatments for genuine halitosis, even though they do not have oral malodour. A classification system can also be used to identify patients with halitophobia

25. **den Broek (2007)** [59] in his review of the current literature on aetiology and measurement methods of halitosis finds organoleptic measurement and gas chromatography reliable, but not easily clinically implemented methods. He also says that organoleptic measurement is the 'gold standard'. if precise measurements of

specific gases are needed then Gas chromatography is used . Sulphide monitoring can also be used for the same.

26. **Annemiek M.W.T. (2007)** [2] in his review of the current literature on aetiology and measurement methods of halitosis states that in approximately 80–90% of all cases, halitosis is caused by oral conditions, defined as oral malodour. He further states that oral malodour resulted from tongue coating, periodontal disease, peri-implant disease, deep carious lesions, exposed necrotic tooth pulps, pericoronitis, mucosal ulcerations, healing (mucosal) wounds, impacted food or debris, imperfect dental restorations, unclean dentures, and factors causing decreased salivary flow rate.

    Non-oral aetiologies of halitosis included disturbances of the upper and lower respiratory tract, disorders of the gastrointestinal tract, some systemic diseases, metabolic disorders, medications, and carcinomas. Stressful situations were also found to be predisposing factors.

    Three primary measurement methods of halitosis were discussed : Organoleptic measurement and gas chromatography were found reliable. The use of organoleptic measurement was suggested as the ‘gold standard. Sulphide monitoring was an easily used method.

    additional or alternative measurement methods considered were : BANA test, chemical sensors, salivary incubation test, quantifying β-galactosidase activity, ammonia monitoring, ninhydrin method, and polymerase chain reaction.

27. **Nardi GM ,(2009)** [36] Considered halitosis to be both a stomatological and psychological issue. According to them halitosis was the manifestation of an organic malfunctioning of the oral apparatus, and a problematic element for the individual and his/her relational life.

28. **Nalini Saini and Puneet Ajwani (2012)** [35] in their study on Oral Malodor found that anaerobic bacteria, oxygen depletion, alkaline pH and sulfur-containing substrates are some of the requirements for oral malodor to occur.

29. **Jörgen slots** [24] carried out the roll tube culture technique to study the predominant cultivable microorganisms harbored in the base of deep periodontal pockets of eight patients aged 34–48 years . From a total of 475 isolates, 425 (89.5 %) were obligate anaerobes, 356 (74.9 %) were Gram-negative, and 441 (92.8%) were categorized as rods. Baeteroides melaninogenicus and Fusobacterium nucleatuni constituted the majority of the isolates in seven samples .Gram-negative anaerobic rods were the most predominant organisms in seven of the eight samples and averaged 74.3 % of the cultivable microflora.

30. **Jörgen slots** [25] in his study compared five growth media and two anaerobic techniques for isolating bacteria from dental plaque

    The agar media tested were

    1."plaque" medium (JENSEN, LOE, SCHIOTT & THEILADE 1968)

    2. N2C (Nutrient-Cystein medium) (CILMOUR & PooLE 1970).

    3. HIA-10% B (Heart Infusion Agar - 10% Blood) (GORDON et al. 1971).

4. BHIA-Suppl. (jBrain Heart Infusion .i4garSupplemented) (HOLDEMAN & MOORE 1973).

5. MM 10 (Modified iWedium 10) (LOESCHE & SYED 1973)

The media for the roll tube and the conventional anerobic jar technique were identical except that resazurin was added to the roll tube media as an indicator of the anaerobic condition

Supra and subgingival dental plaque samples were removed from 10 males and females aged 20 to 69 years by the use of periodontal curettes.

The plating procedure was :

1)Roll tube technique

2)Conventional anaerobic jar technique

The results of this study emphasized the importance of strictly anaerobic conditions, such as in the Hungate roll tube technique, for optimally non-selectively isolating microorganisms from dental plaque. The conventional anaerobic jar technique was in this respect only about half as effective as the roll tube technique

31. **P.P. Morris** [42] evaluated the effect of prophylaxis and antisepsis on Halitosis . A pool was developed by evaluating a large group of available subjects. Sixty-five per cent of the subjects available had frequent odor levels of three or above (pO above 3). Only such subjects were used .

The subjects comprising any group in immediate use were selected from the pool on the basis of convenience only. When necessary to divide a group into control and test sections, this was done at random..

Saliva Putrefaction

Saliva Putrefaction in Vivo

Dilution of a Mouth Rinse by Saliva

Effect of Dental Prophylaxis on Odors

Effect of Tongue Prophylaxis on Odors

Effect of Dentifrice

Effect of Antiseptic and Water Rinse on Odor

Effect of Antiseptic on Morning Mouth

Effect of Antiseptic on Odors due to Smoking

Resistant Types of Odors

Saliva putrified rapidly on incubation, giving rise to very objectionable odors. Dilution with only 6 per cent of the antiseptic preventsed putrefaction completely

The application of water as a mouth rinse did not affect rate of putrefaction of saliva collected during subsequent two hours.

Complete dental prophylaxis reduced mouth and breath odors to an unobjectionable level for more than two hours.

Tongue prophylaxis, by mechanical means only, reduced mouth and breath odors to a low level.

Dentifrice used in the normal manner reduced mouth and breath odors materially, the odor level returning to the objectionable level in two hours.

Water rinse was without effect on mouth and breath odors.

Stagnation of saliva in the mouth overnight resulted in an odor intensity of objectionable level, even though the subject had a normally low daytime level

Tobacco odors were materially reduced by the antiseptic rinse but not by a water rinse There are certain resistant types of odors, such as that due to garlic, that are systemic in origin and were not affected by water or the antiseptic rinse.

STUDIES RELATING FIXED ORTHODONTIC APPLIANCE AND HALITOSIS

32. **BjȼRN U. ZACHRISSON, (1973)** [8] studied the Periodontal Condition in Orthodontically Treated and Untreated Individuals and found that orthodontic patients showed significantly more alveolar bone loss radiographically than did the untreated subjects. Mean CEJ-AC distance was 1.11 mm in the treated group and 0.88 mm in the untreated group.

33. **Atack NE, Sandy JR, Addy M. (1996)** [1] reviewed the Periodontal and microbiological changes associated with the placement of orthodontic appliances and found that there is a shift in the subgingival microflora soon after band placement to a periopathogenic population with increases in anaerobic rods, particularly Prevotella and Bacteroides species, fusiform bacteria, and spirochetes. These changes in subgingival microbiology seemed to be reflected clinically in most patients with an increase in gingival inflammation and, regardless of the level of oral hygiene, an increase in gingival enlargement

34. **Hasan Babacan et al (2011)** [20] studied the effect of fixed appliances on oral malodor and found that halitosis reached the critical level during fixed orthodontic treatment. The PI and GI scores also increased immediately after bonding. He suggested that halitosis could be used as another indicator to evaluate oral health and can be used to guide patients to achieve ideal oral hygiene

35. **Oral Sökücü (2016)** [49] studied the effects of fixed appliances on oral malodor from beginning of treatment till 1 year found that

    - Orthodontic treatment affected oral malodor with regard to the PI, GI, and PPD.
    - The critical limit of oral malodor was reached at the end of 7 months.

    They suggested that oral malodor can be used as an indicator to evaluate the oral health of patients.

36. **Huang, Jing (2018)** [21] did a systematic review and meta-analysis on effects of fixed orthodontic brackets on oral malodor and found that fixed orthodontic treatment appeared to be a risk factor for malodor, independent of periodontal changes, and self ligating brackets systems controlled malodor better than conventional bracket systems

STUDIES REGARDING TREATMENT MEASURES FOR HALITOSIS

37. **S. Roldán E. G. Winkel** [47] studied the effects of a new mouthrinse containing chlorhexidine, cetylpyridinium chloride and zinc lactate on the microflora of oral halitosis patients. It was a dual-centre, double-blind placebo-controlled study. They observed significant positive correlation between the reduction in total counts in saliva samples and the reduction in organoleptic scores in the test group. Significant reductions in total counts and proportions of F. nucleatum and total counts of P. intermedia in tongue coating samples were observed in the test group.

38. **V. J. RICHTER and J. TONZETICH , (1964)** [60] studied the application of instrumental techniques for the evaluation of odoriferous volatiles from saliva and breath.

Chemical tests indicated that volatile sulphur compounds were the primary odoriferous components of saliva. Their presence was confirmed in the volatiles using two instruments, the mass spectrometer and a Titrilog. With instrumental techniques it was found that the concentrations of the odoriferous sulphur constituents increase with increased incubation time and were proportional to the odour intensity as perceived by organoleptic perception.

A Titrilog (Consolidated Electrodynamics Corporation), a sensitive instrument capable of measuring volatile oxidizable sulphur components almost exclusively, was employed to identify the odoriferous volatiles from saliva.

Two different Titrilogs were utilized, a pressure and a vacuum model.

From the results which are at best qualitatitve, it was concluded that, under the conditions employed, no quantitative measurements could be realized. Either more refined measuring tools or more elaborate means of concentration must be adopted

39. **Löe, H. (1967)** [27] reviewed the Gingival Index, the Plaque Index and the Retention Index Systems. The main purpose of creating the Gingival Index system was to introduce a system for the assessment of the gingival condition which clearly distinguished between the quality of the gingiva (the severity of the lesion) and the location (quantity) as related to the four (buccal, mesial, distal, lingual) areas which make up the total circumference of the marginal gingiva (Löe and Silness, 1963).

    Although Russell's Periodontal Index has two scores for gingivitis (scores 1 and 2), this index does not really consider different qualities of gingival inflammation.

40. **M. Rosenberg, G.V. Kulkarni (1991)** [31] Studied the reproducibility and sensitivity of oral malodor measurements with a portable sulphide monitor.

    Forty-one subjects with bad breath were assessed for oral malodor and periodontal status on three occasions, at intervals of approximately one week. Oral malodor was assessed by measurement of peak and steady-state volatile sulphide levels with a portable sulphide monitor and by organoleptic measurement of whole-mouth, tongue

dorsum, and interproximal dental odors . They concluded that the sulphide monitor may be a valuable tool for assessment of oral malodor based on the superior reproducibility and sensitivity of the sulphide measurements compared with organoleptic measurements,. However, it lacked the specificity of gas chromatography, since it couldn't distinguish between the proportions and species of different VSC's

41. **Mel Rosenberg , Idit Septon (1991)** [32] measured halitosis by an Industrial Sulphide Monitor .

They studied 75 volunteers, ranging in age from 11 to 77 years (average age = 47.3 ± 16.7). For organoleptic measurements, volunteers were instructed to exhale briefly through the mouth, at a distance of approximately 10 cm from the nose of the organoleptic panel member. Organoleptic results were recorded independently by each judge on a scale of 0 to 5. Volatile sulphide measurements were performed using a 1 ppm full scale hydrogen sulphide monitor .They suggested that quantitation of volatile oral sulphides, using a portable sulphide monitor, can provide rapid, objective halitosis-related measurements.

42. **Brunette DM , Proskin HM , Nelson BJ (1998)** [9] studied the effects of dentifrice systems on oral malodor . They used Gas chromatography, for accurate measurements of breath VSC, in 11 men after brushing with baking soda-containing dentifrices with or without the addition of Zn++. Dentifrices with either Zn++ or a concentration of baking soda 20% or greater significantly reduced VSC levels. The addition of Zn++ to baking soda dentifrices enhanced the anti-odor effects.

In the first organoleptic study, dentifrices containing 20% baking soda and 30% baking soda demonstrated significantly greater ability to reduce breath odor than a standard sodium fluoride/silica dentifrice

The findings of this study indicated that dentifrices containing 20% or more baking soda can confer a significant odor-reducing benefit for time periods up to three hours.

43. **Loesche WJ , Kazor C (2002)** [28] studied the Microorganisms causing halitosis and studied various treatment methods of halitosis. They found that many thousands of individuals who experience oral malodor from the overgrowth of proteolytic, anaerobic bacteria on their tongue surfaces can be successfully treated by a regimen that includes tongue brushing, toothbrushing and possibly the usage of mouthrinses containing various agents. Several candidate used mouthrinses containing essential oils (Listerine), ZnCl2, or an oil, water and cetylpyridum chloride mouthrinse had reduced organoleptic scores of individuals with moderate levels of oral malodor in the absence of tongue brushing .They suggested that two treatment approaches can be used to accomplish this goal: debriding the tongue and tooth surfaces by physical means and/or reducing the bacterial load by chemical agents delivered via mouthrinses, dentifrices, lozenges, etc. Both approaches seeked the nonspecific reduction of all bacterial types.

STUDIES REGARDING ROLE OF CHLORHEXIDINE IN TREATMENT OF HALITOSIS

44. **Per Axelsson Jan Lindhe (1987)** [43] studied the efficacy of mouthrinses in inhibiting dental plaque and gingivitis in man. 96 volunteers were recruited for the study. During the 6 weeks of trial, the subjects continued to exercise their regular non-supervised, self-performed plaque control measures. The 96 volunteers were assigned either to 1 or 3 different treatment groups or to a control group according to a randomized code. During the 6 weeks of trial, the subjects continued to exercise their regular non-supervised, self-performed plaque control measures. The members of the control group and the listerine group rinsed with 20 ml of the mouthrinse for 30 s, twice daily, while the members of the chlorhexidine groups (using either a 0.2% or a 0.1% solution) rinsed with 10 ml of the antiseptic solution for 60 s twice daily extrinsic stain was evaluated using the Lobene index, plaque was assessed by the Turesky modification of Quigley-Hein index and the gingival condition was examined using the gingival index system of Loe & Silness. The results of the trial demonstrated that the 3 active mouthwash preparations used as supplements to regular tooth cleaning measures markedly improved both the oral hygiene status and the gingival conditions of the participating human volunteers, compared to the control rinse.

45. **Anderson GB (1997)** [5] studied Clinical effects of chlorhexidine mouthwashes on patients undergoing orthodontic treatment and found that the use of the CHX, in addition to regular oral hygiene habits, was effective in reducing plaque and gingivitis in adolescents undergoing orthodontic treatment.

46. **P.K.Sreenivasan (2004)**[40] studied the effects of a chlorhexidine mouthrinse on culturable microorganisms of the tongue and saliva. He collected saliva and tongue scrapings from 13 subjects prior to treatments with additional samples collected at 3 h post-treatment cultured on media to enumerate anaerobic, Gram-positive and Gram-negative bacteria, odorigenic bacteria producing hydrogen sulphide {H_2S} and oral bacteria with proteolytic activity. In comparison to the control, rinsing with CHX demonstrated statistically significant reductions that ranged from 81–90% for tongue microflora with a 89–95% decrease noted on salivary flora

STUDIES REGARDING ALTERNATIVE ORAL HYGIENE MEASURES IN TREATING HALITOSIS

47. **Asokan S, (2009)** [3] did a randomized controlled pilot trial to determine the effect of oil pulling on plaque induced gingivitis

    He evaluated the effect of oil pulling with sesame oil on plaque-induced gingivitis and compared its efficacy with chlorhexidine mouthwash.

    A total of 20 age-matched adolescent boys with plaque-induced gingivitis were selected . They were divided randomly into the study or oil pulling group (Group I) and the control or chlorhexidine group (Group II) with 10 subjects in each group. Plaque index

and modified gingival index scores were recorded for the 20 subjects and baseline plaque samples were also collected.

The plaque samples were used to identify the microorganisms and to measure the total colony count of the aerobic microorganisms present

There was a statistically significant reduction of the pre- and post-values of the plaque and modified gingival index scores in both the study and control groups

The oil pulling therapy showed a reduction in the plaque index, modified gingival scores, and total colony count of aerobic microorganisms in the plaque of adolescents with plaque-induced gingivitis.

48. **Sharath Asokan, (2011)** [48] did a randomized controlled pilot trial to determine the effect of oil pulling on halitosis and microorganisms causing halitosis. The results of the study indicated that oil pulling was equally effective in controlling halitosis.

49. **Poonam Sood (2014)** [38] conducted a randomized controlled trial to compare the efficacy of oil pulling and chlorhexidine on oral malodor . The study showed that oil pulling therapy is equally effective like chlorhexidine in reducing oral malodor and microorganisms causing halitosis. The results indicated that the antimicrobial and anti oxidant action of sesame oil and chlorhexidine is responsible for decreased bacterial count, reduction in volatile sulphur compounds and hence scores.The saponification and emulsification process during oil pulling is responsible for cleansing action of sesame oil . It also generates antioxidants which kill microbes and cause their cell wall damage

STUDIES REGARDING COMPARISION OF VARIOUS ORAL HYGIENE MEASURES

50. **Sarit Goldberg &Mel Rosenberg (1991)** [53] Compared the Bacterial desorption by commercial mouthwashes vs two-phase oil: Water formulations. They compared two such formulations with other commercial mouthwashes for their ability to desorb microorganisms from a solid surface (polystyrene). Of the various mouthrinses tested, only the oil:water formulations efficiently removed the adherent bacterial layer. The results suggested that oil:water mouthwashes may have desorption properties superior to those of many commercial mouthwashes

STUDIES REGARDING EFFECIVENESS OF VARIOUS ORAL HYGIENE MEASURES IN ORTHODONTIC PATIENTS

51. **Nicholas F. Schmidt (1987)** [37] studied the effects of oral rinses on organoleptic mouth odor ratings and levels of volatile sulfur compounds . The study involved a test mouthwash, saline rinse, and no treatment and these were evaluated for their effects on organoleptic mouth odor ratings (OR) and corresponding concentrations of volatile sulfur compounds (VSC) in sixty-two subjects. The test mouthwash were significantly superior to the saline rinse and to no treatment in reducing OR and VSC for 3 hours, which was the duration of the study

MATERIALS AND METHODS

MATERIALS

Orthodontic brush	(STIM)Global dent aids private limited.
Toothpaste	colgate – palmolive (India) Limited, colgate research centre,Hiranandani Gardens,Powai,Mumbai
Hexidine oral rinse (chlorhexidine 0.2% w/v)	ICPA , Andheri East-pharmaceutical manufacturers in Mumbai
NORMAL SALINE (0.9%)	varni corporation , Ahmedabad , Gujarat , India
GINGELLY OIL	(IDHAYAM) v.v.v & sons edible oils limited , Virudhunagar , Tamilnadu
Metal brackets 0.022’ size	Orthox , JJ orthodontics pvt.ltd , Periyamet , Chennai, Tamilnadu
sealant	TransbondXT,3MUnitek ,Monrovia,california
Niti wires	(KODEN)KCK dental pvt.ltd , Calicut , Kerala, India

Bands	KCK dental pvt.ltd , Calicut , Kerala , India
Breath checker	Tanita corporation of america.inc , Illinosis , USA
Paper points	NUMBER 30 -META BIOMED CO.LTD , Korea
Reduced transport fluid	HI MEDIA , L.B.S. Marg, Mumbai , India
Thyoglycolate broth	HI MEDIA , L.B.S. Marg, Mumbai , India
Blood agar	HI MEDIA , L.B.S. Marg, Mumbai , India
Test tubes	HI MEDIA , L.B.S. Marg, Mumbai , India
Periodontal probe	Williams probe ,Hu – Friedy ,Chicago ,III)
Tweezers	
Mouth mirror	

METHODOLOGY

SELECTION OF SUBJECTS

40 patients in age group of 14 years to 20 years for whom fixed orthodontic treatment was planned to be done were selected for the study .

INCLUSION CRITERIA

1. Class I dentoalveolar malocclusion
2. Healthy individuals

EXCLUSION CRITERIA

1. History of antibiotic use within the past 3 months.
2. History of otolaryngology consultation due to sinusitis, tonsillitis or tonsilloliths, within the past 3 months.
3. Already in habit of using mouth washes.

The 40 study subjects were randomly divided into 4 study groups with each group allotted with one oral hygiene measure along with regular brushing using bass method with STIM orthobrush and COLGATE toothpaste by examiner 1.

The total of 40 patients were divided into 4 groups:

GROUP	**SAMPLE SIZE**	**ORAL HYGIENE MEASURE**	**FREQUENCY**
GROUP 1	10	REGULAR BRUSHING + PLACEBO	TWICE DAILY FOR 3 MIN
GROUP 2	10	BRUSHING + NORMAL SALINE	BRUSHING : 3 MIN NORMALSALINE:TWICE DAILY FOR 3 MIN
GROUP 3	10	BRUSHING + OIL PULLING	BRUSHING : 3 MIN NORMALSALINE:TWICE DAILY FOR 5 MIN
GROUP 4	10	BRUSHING + HEXIDINE MOUTHWASH	BRUSHING : 3 MIN NORMALSALINE:TWICE DAILY FOR 3 MIN

GROUP 1:

Patients in group 1 were instructed to follow normal regular tooth brushing technique (modified bass technique) and placebo twice daily for 3 minutes .

GROUP 2 :

Patients in group 2 were instructed to follow normal regular tooth brushing technique (modified bass technique) along with normal saline (0.9%) for mouthrinsing twice daily for 3 minutes

GROUP 3 :

Patients in group 3 were instructed to follow normal regular tooth brushing technique (modified bass technique) along with oil pulling twice daily for 5 minutes

GROUP 4 :

Patients in group 4 were instructed to follow normal regular tooth brushing technique (modified bass technique) along with chlorhex mouthwash for mouthrinsing twice daily for 3 minutes

TIMELINE FOR DATA COLLECTION

T0 - immediately after banding and bonding

T1 – 10 days after bonding

T2 – 20 days after bonding

IRB clearance was obtained. All the patients underwent oral hygiene prophylaxis by a periodontist (examiner 2) who was blinded to the study. Fixed orthodontic treatment was started for these patients.

Parameters collected at T0,T1,and T2were:

1) Gingival index (Examiner 2)
2) Plaque index (Examiner 2)

Oral malorder scoring by

3) Organoleptic method (Examiner 2)
4) Breath checker (Examiner 2)

Colony count:

5) Anaerobic bacterial count(Examiner 1)

GINGIVAL INDEX

- The gingival index was based on method developed by Loe H.
- GI was recorded on mesial , disatl, buccal , and lingual surfaces . a manual periodontal probe (williams probe ,Hu – Friedy, chicago ,III) was used .
- Bleeding was recorded if occuring within 30 seconds of probing.

Scoring

GI – O : Gingiva pale pink to pale and firm

GI – 1 : mild inflammation

GI – 2 : moderately inflammed gingiva

GI – 3 : severe inflammation

PLAQUE INDEX

- The plaque index (PI) was scored based on silness and loe method
- PI was recorded at 4 tooth surfaces (mesial , distal,buccal,and lingual)

Scoring

Grade 0 : no plaque discernible visually or using the probe

Grade 1 : not visible thin coating of plaque which is only visible after using the probe

Grade 2 : moderate accumulation of plaque ,visible with the naked eye , but not filling interdental space

Grade 3 : abundance of plaque , filling interdental space

The scores of the groups were subsequently calculated by adding the individual scores and dividing the total by the number of subjects involved.

ORGANOLEPTIC METHOD

- The organoleptic scoring was done based on method described by De Boever and loesche [13] by the same periodontist.

Score 0 : no appreciable odor

Score 1 : barely noticeable odor that is of low intensity and within acceptable limits

Score 2: slight to moderate odor that is clearly noticeable and slightle unpleasent

Score 3: moderate to high odor that is clarly noticeable , unpleasent and moderate intensity

Score 4 : offensive odor of strong intensity

The readings were repeated three times and their averages were taken.

BREATH CHECKER

- The breath checker used the scores from 0 to 5
- The sensor is kept a distance of 1 cm from mouth. The patient exhales for 4 seconds.

  Score 0 : no odour

  Score 1 : slight odour

  Score 2: moderate odour

  Score 3: heavy odour

  Score 4: strong odour

  Score 5: intense odour

  The scoring was done by the same periodontist. (Examiner 2)

MICROBIAL CULTURE

After the breath analysis was completed , the gingival crevicular fluid (GCF) samples were collected from patients mouth using paper points at the mesiobuccal and mesiopalatal aspect of the molar tooth and they were placed immediately in 1 ml of Reduced Transport Fluid (RTF) and in Thyoglycolate broth in a 1.5 cm test tubes. The paper points with blood stains were discarded. The samples were immedietely transported with in half an hour to the department of microbiology , Stanley medical college . these samples were plated with in half an hour to one hour in anaerobic blood gar and in aerobic blood agar under strict anaerobic condition using Gaspak in Mcintosh and Filde's anerobic jar . They were simultaneously inoculated in blood agar plates in aerobic condition at 37°c for 2 days and furthur incubated for 4 days.

Aerobic tolerance has been proved. Garm staining was carried out and visualized through microscopy. Biochemical tests were carried out for all bacteria for confirmation. The number of colonies were estimated in terms of colony forming units (CFU) .

The predominant microorganisms were determined and their count was noted down.

All the subjects were evaluated during their first appointment to establish their T0 readings.

The subjects were instructed to carry out their oral hygiene practice along with the one prescribed to them. They were asked to brush after dinner and avoid drinking and eating until the next morning. They were asked to restrain from eating spicy food, onions,garlic for 48 hours prior to appointment. The subjects were banded and bonded at the same appointment .

All the first molars were banded by conventional method and the teeth were bonded by conventional method . They were etched for 20 seconds with 37 % phosphoric acid and washed

for 10 seconds with a spray and dried till chalky white appearance . Then a sealent was applied. Metal brackets were bonded on both arches in same session. Nickle – titanium leveling archwires were placed on both arches using eastomeric ligatures on all teeth.

After the collection of T0 samples , patients were instructed to carry on with their oral hygiene measures and T1 samples were collected after 10 days. Similarly T2 samples were collected after 20 days.

1. COMPARISON OF THE MEAN BASELINE VALUES OF THE VARIABLES:

PARAMETERS	GROUP	MEAN (SD)	P VALUE
GI	CHX	1(0)	.915*
	OIL	1.1(.31)	
	NORMAL SALINE	1.1(.31)	
	CONTROL	1.1(.31)	
PI	CHX	1(0)	.844*
	OIL	1(0)	
	NORMAL SALINE	1.1(.31)	
	CONTROL	1.1(.31)	
ORGANOLEPTIC METHOD	CHX	1.9(.56)	.751*
	OIL	1.6(.51)	
	NORMAL SALINE	1.5(.52)	
	CONTROL	1.2(.78)	
BREATH SCORE	CHX	.6(.03)	.824*
	OIL	.73(.01)	
	NORMAL SALINE	.77(.05)	
	CONTROL	1.03(.24)	
ABC	CHX	5.15(.75)	.973**
	OIL	4.52(.76)	
	NORMAL SALINE	4.34(.64)	
	CONTROL	4.25(.63)	

*P>0.05, KRUSKAL WALLIS TEST; **P>0.05, ANOVA

2. COMPARISON OF THE MEAN T1 VALUES OF THE VARIABLES:

PARAMETERS	GROUP	MEAN (SD)	P VALUE
GI	CHX	1.3(.48)	.000*
	OIL	1.3(.48)	
	NORMAL SALINE	1.4(.51)	
	CONTROL	1.6(.51)	
PI	CHX	1.8(.42)	.004*
	OIL	1.5(.52)	
	NORMAL SALINE	1.5(.52)	
	CONTROL	1.8(.42)	
ORGANOLEPTIC METHOD	CHX	.9(.5)	.022*
	OIL	.9(.5)	
	NORMAL SALINE	.8(.42)	
	CONTROL	1.6(.51)	
BREATH SCORE	CHX	.5(.01)	.007*
	OIL	.5(.01)	
	NORMAL SALINE	.6(.04)	
	CONTROL	1(.6)	
ABC	CHX	3.12(1.07)	.000**
	OIL	3.25(.41)	
	NORMAL SALINE	3.31(.72)	
	CONTROL	3.42(1.2)	

*P<0.05, KRUSKAL WALLIS TEST; **P<0.05, ANOVA

3. COMPARISON OF THE MEAN T2 VALUES OF THE VARIABLES:

PARAMETERS	GROUP	MEAN (SD)	P VALUE
GI	CHX	.7(.4)	.048*
	OIL	.7(.4)	
	NORMAL SALINE	1.4(.51)	
	CONTROL	1.7(.48)	
PI	CHX	1(0)	.000*
	OIL	1(0)	
	NORMAL SALINE	1.4(.51)	
	CONTROL	1.8(.6)	
ORGANOLEPTIC METHOD	CHX	.5(.04)	.005*
	OIL	.4(.02)	
	NORMAL SALINE	.6(.05)	
	CONTROL	1.8(.42)	
BREATH SCORE	CHX	.4(.01)	.000*
	OIL	.4(.01)	
	NORMAL SALINE	.5(.02)	
	CONTROL	1(.6)	
ABC	CHX	2.01(1.32)	.016**
	OIL	1.77(.63)	
	NORMAL SALINE	1.87(.71)	
	CONTROL	3.09(.94)	

*P<0.05, KRUSKAL WALLIS TEST; **P<0.05, ANOVA

4. COMPARISON OF THE MEAN VALUES OF THE VARIABLES AMONG THE THREE TIME INTERVALS IN CHX GROUP:

PARAMETERS	TIME INTERVAL	MEAN (SD)	P VALUE
GI	0 DAY	1(0)	.000*
	10 DAY	1.3(.48)	
	20 DAY	0.7(.4)	
PI	0 DAY	1(0)	.000*
	10 DAY	1.8(.42)	
	20 DAY	1(0)	
ORGANOLEPTIC METHOD	0 DAY	1.9(.56)	.000*
	10 DAY	0.9(.5)	
	20 DAY	0.5(.52)	
BREATH SCORE	0 DAY	.6(.03)	.000*
	10 DAY	.5(.01)	
	20 DAY	.4(.01)	
ABC	0 DAY	5.15(.75)	.000**
	10 DAY	3.12(1.07)	
	20 DAY	2.01(1.32)	

*P<0.05, KRUSKAL WALLIS TEST; **P<0.05, ANOVA

5. COMPARISON OF THE MEAN VALUES OF THE VARIABLES AMONG THE THREE TIME INTERVALS IN OIL GROUP:

PARAMETERS	TIME INTERVAL	MEAN (SD)	P VALUE
GI	0 DAY	1.1(.31)	.000*
	10 DAY	1.3(.48)	
	20 DAY	0.7(.4)	
PI	0 DAY	1(0)	.000*
	10 DAY	1.5(.52)	
	20 DAY	1(0)	
ORGANOLEPTIC METHOD	0 DAY	1.6(.51)	.000*
	10 DAY	0.9(.5)	
	20 DAY	0.4(.02)	
BREATH SCORE	0 DAY	.73(.01)	.000*
	10 DAY	.5(.01)	
	20 DAY	.4(.01)	
ABC	0 DAY	4.52(.76)	.000**
	10 DAY	3.25(.41)	
	20 DAY	1.77(.63)	

*P<0.05, KRUSKAL WALLIS TEST; **P<0.05, ANOVA

6. COMPARISON OF THE MEAN VALUES OF THE VARIABLES AMONG THE THREE TIME INTERVALS IN NORMAL SALINE GROUP:

PARAMETERS	TIME INTERVAL	MEAN (SD)	P VALUE
GI	0 DAY	1.1(.31)	.000*
	10 DAY	1.4(.51)	
	20 DAY	1.4(.51)	
PI	0 DAY	1.1(.31)	.000*
	10 DAY	1.5(.52)	
	20 DAY	1.4(.51)	
ORGANOLEPTIC METHOD	0 DAY	1.5(.52)	.029*
	10 DAY	0.8(.42)	
	20 DAY	0.6(.05)	
BREATH SCORE	0 DAY	.77(.05)	.022*
	10 DAY	.6(.04)	
	20 DAY	.5(.02)	
ABC	0 DAY	4.34(.64)	.000**
	10 DAY	3.31(.72)	
	20 DAY	1.87(.71)	

*P<0.05, KRUSKAL WALLIS TEST; **P<0.05, ANOVA

7. COMPARISON OF THE MEAN VALUES OF THE VARIABLES AMONG THE THREE TIME INTERVALS IN CONTROL GROUP:

PARAMETERS	TIME INTERVAL	MEAN (SD)	P VALUE
GI	0 DAY	1.1(.31)	.031*
	10 DAY	1.6(.51)	
	20 DAY	1.7(.48)	
PI	0 DAY	1.1(.31)	.008*
	10 DAY	1.8(.42)	
	20 DAY	1.8(.6)	
ORGANOLEPTIC METHOD	0 DAY	1.2(.78)	.000*
	10 DAY	1.6(.51)	
	20 DAY	1.8(.05)	
BREATH SCORE	0 DAY	1.03(.24)	.038*
	10 DAY	1(.6)	
	20 DAY	1(.6)	
ABC	0 DAY	4.25(.63)	.000**
	10 DAY	3.42(1.2)	
	20 DAY	3.09(.94)	

*P<0.05, KRUSKAL WALLIS TEST; **P<0.05, ANOVA

CHART 1 COMPARISON OF THE MEAN BASELINE VALUES OF THE VARIABLES

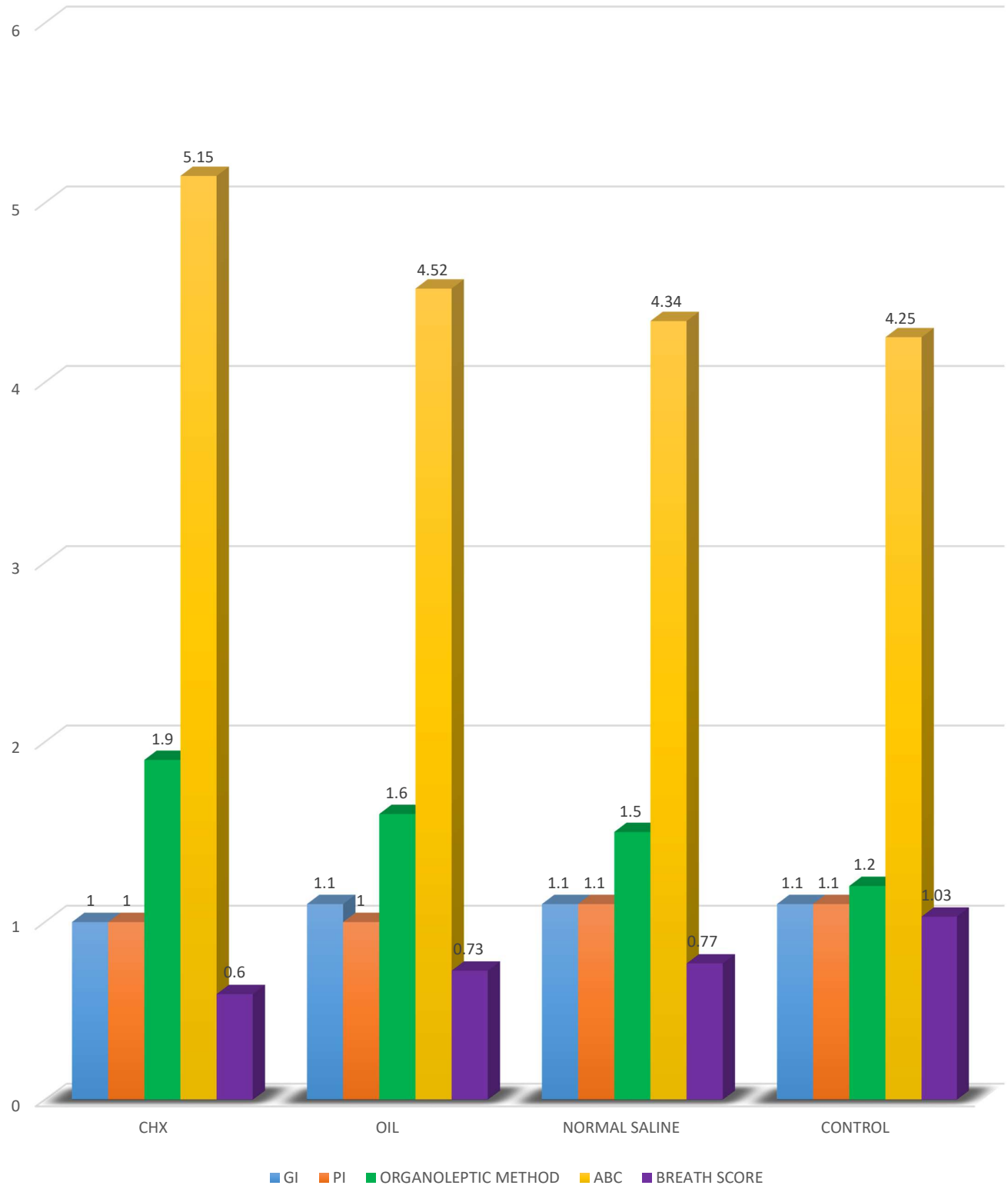


CHART 2 COMPARISON OF THE MEAN T1 VALUES OF THE VARIABLES

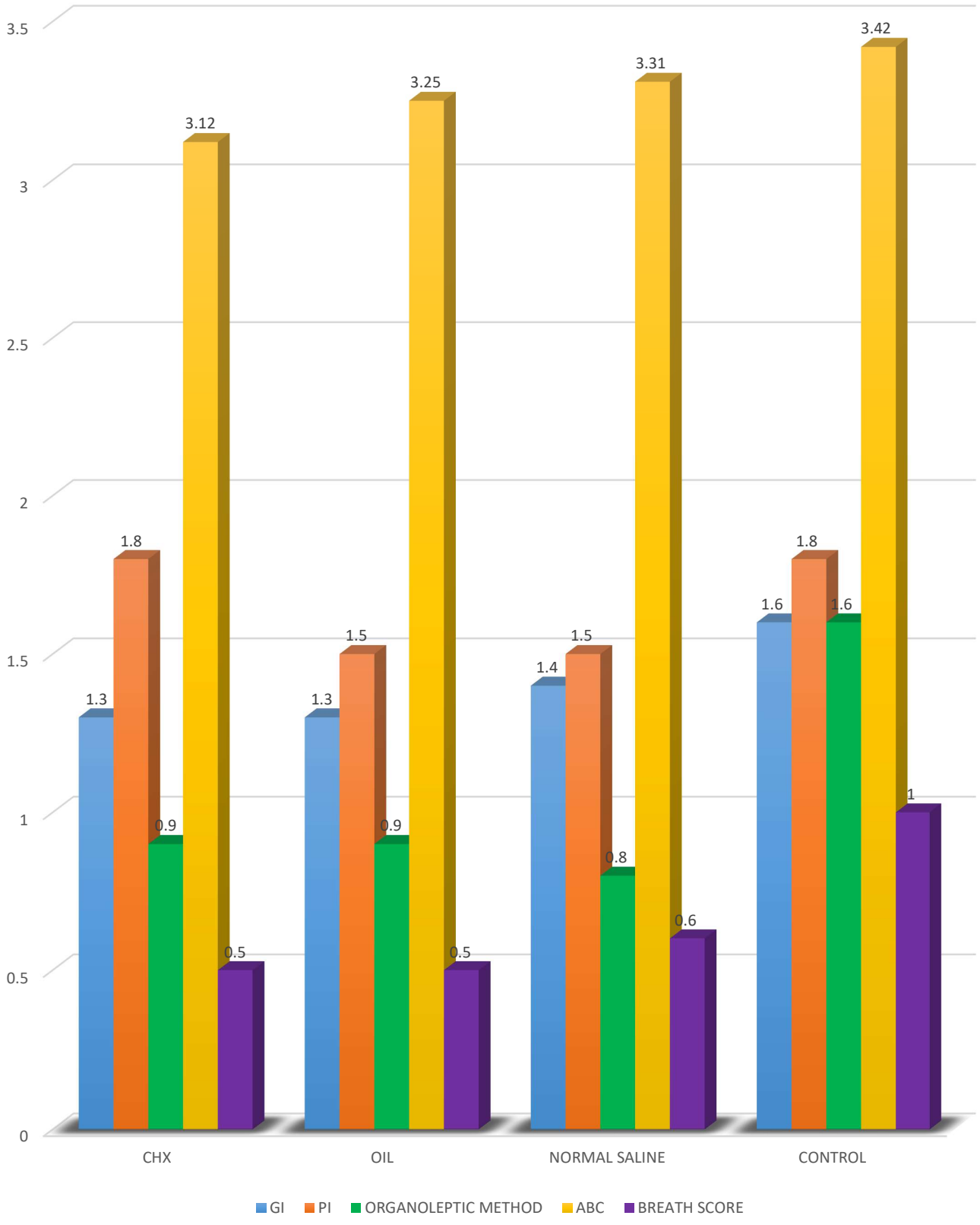
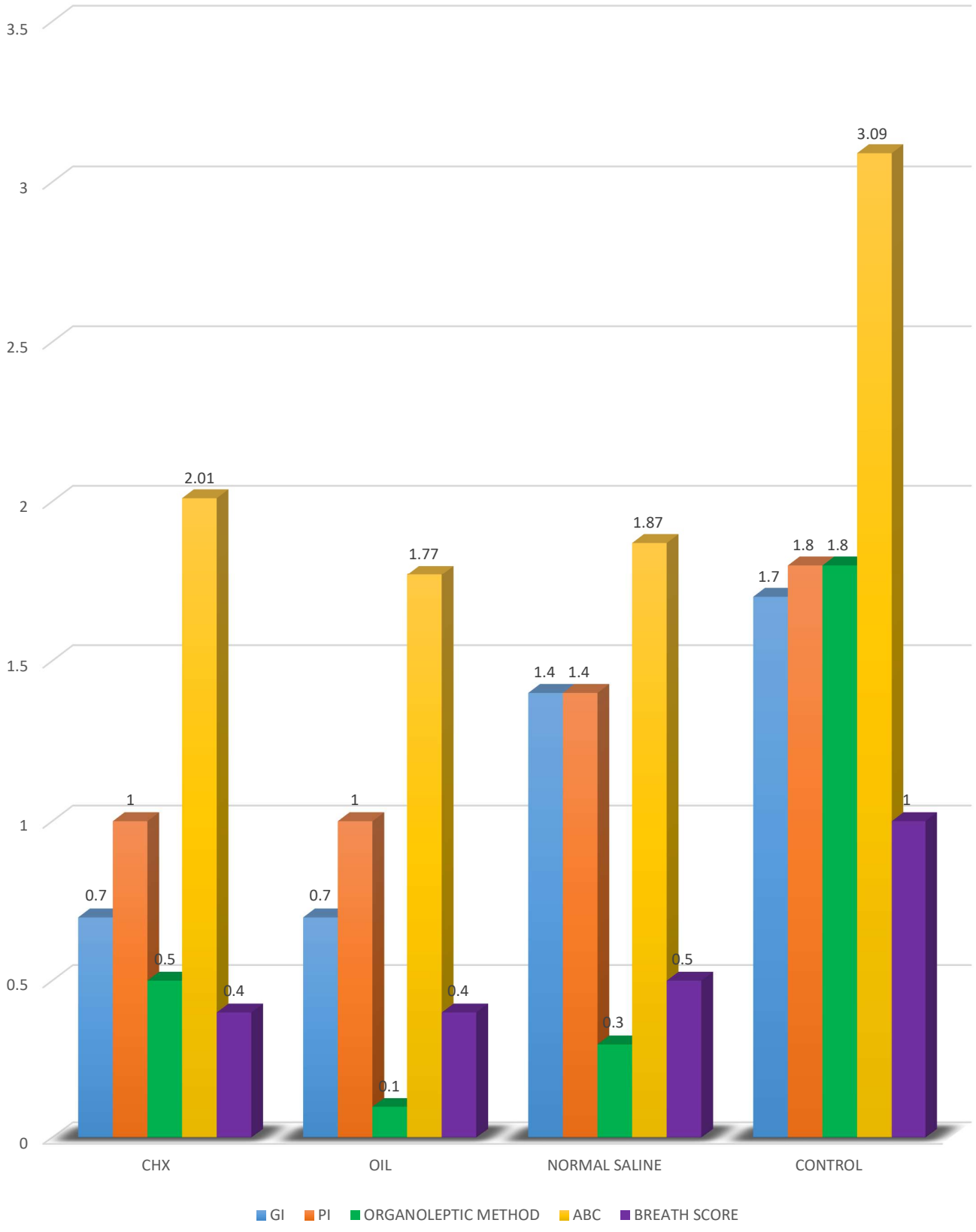
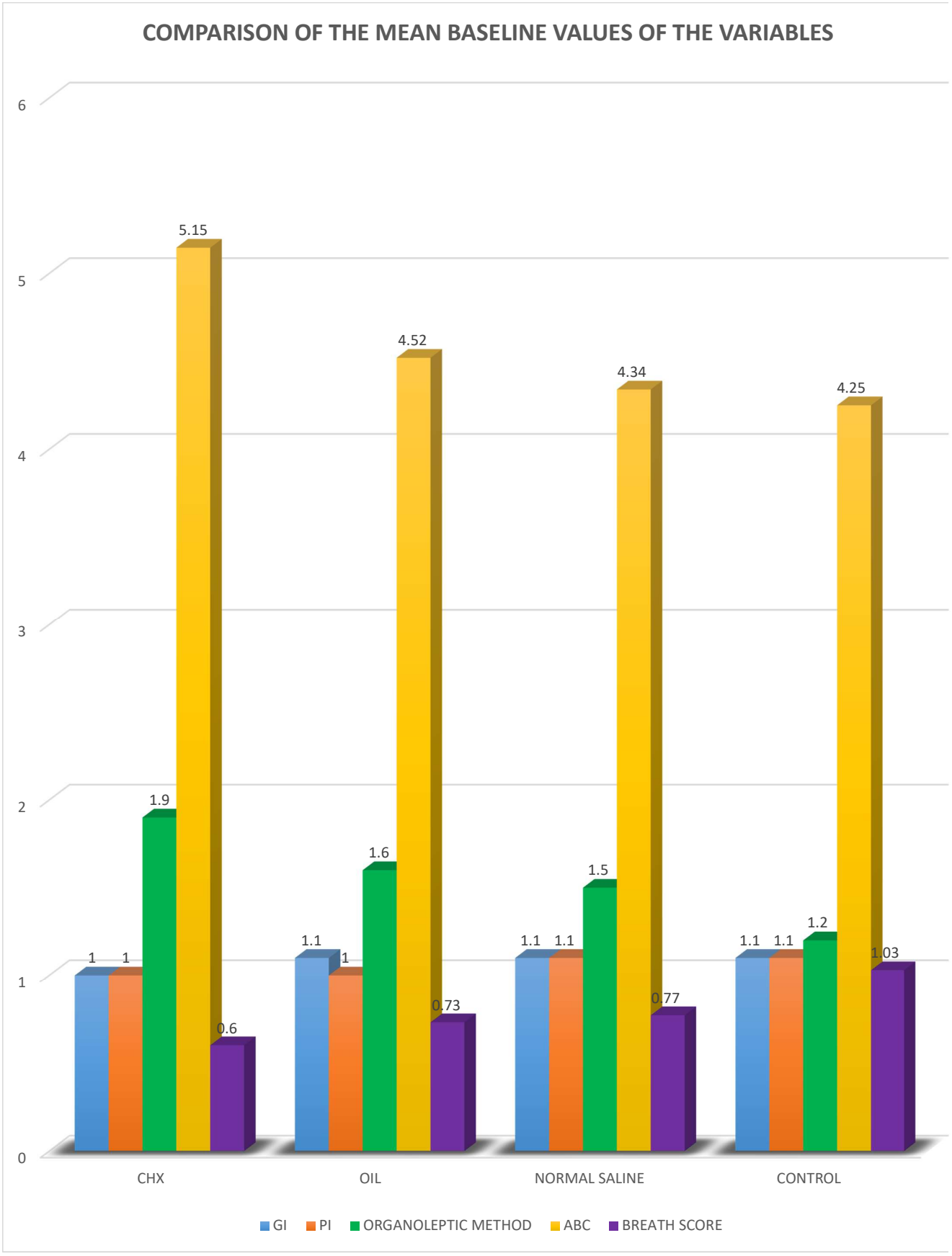
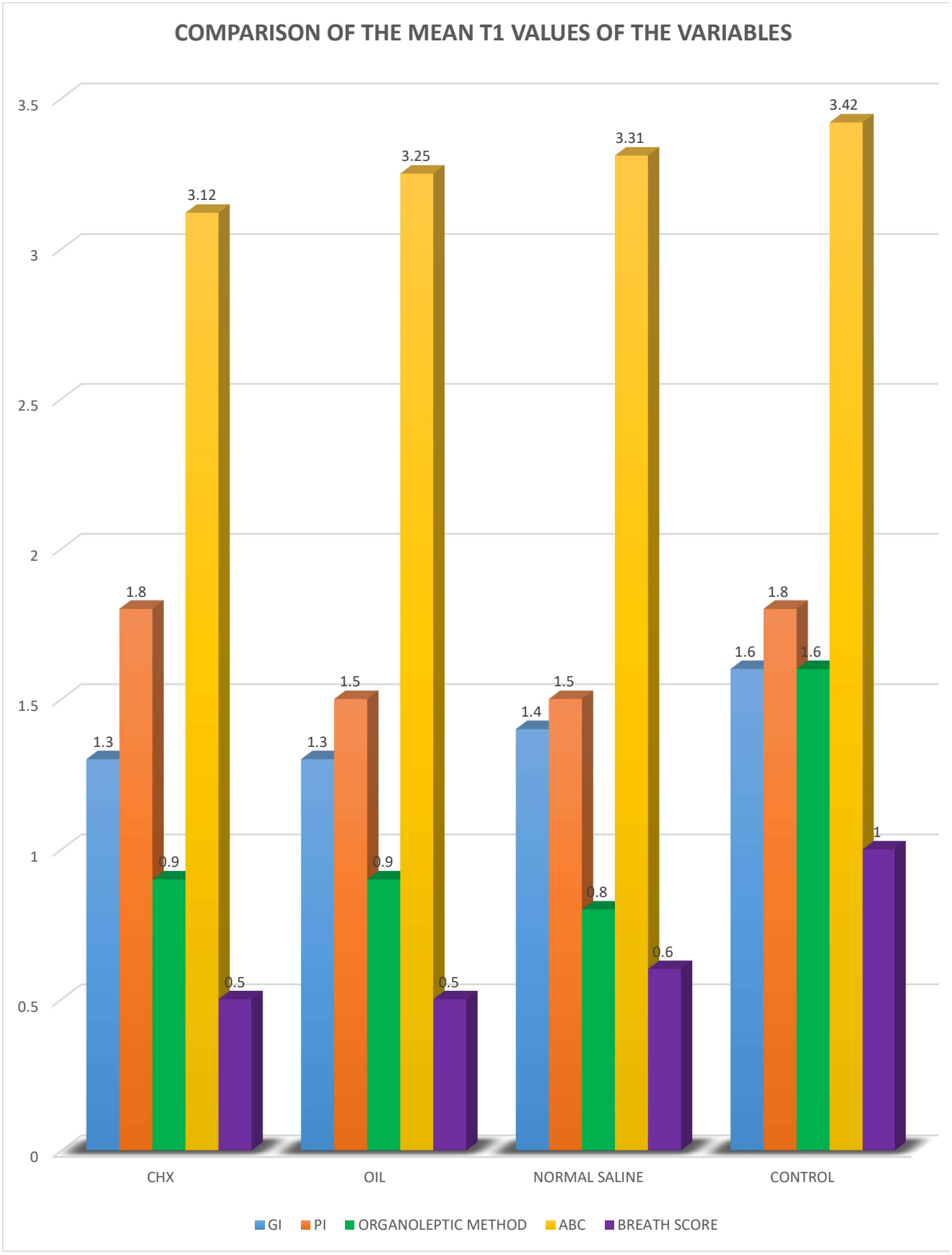
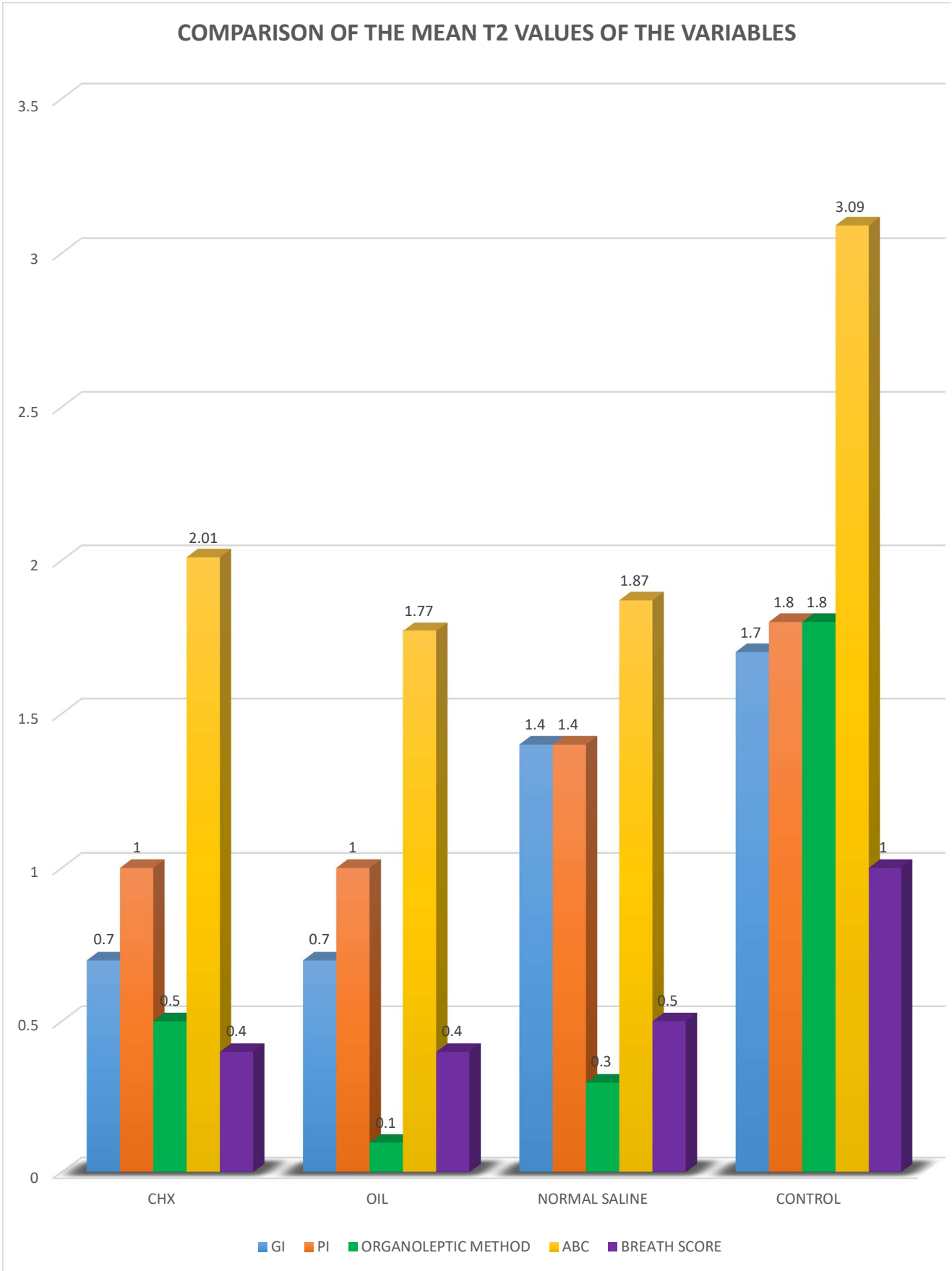


CHART 3 COMPARISON OF THE MEAN T2 VALUES OF THE VARIABLES




COMPARISON OF THE MEAN BASELINE VALUES OF THE VARIABLES
6
5
4
3
2
1
0
5.15
4.52
4.34
4.25
1.9
1.6
1.5
1.2
1.1
1.03
0.77
0.73
0.6
1
1
1.1
1
1.1
1.1
1.1
1.1
CHX
OIL
NORMAL SALINE
CONTROL
GI
PI
ORGANOLEPTIC METHOD
ABC
BREATH SCORE


COMPARISON OF THE MEAN T1 VALUES OF THE VARIABLES
3.5
3
2.5
2
1.5
1
0.5
0
1.3
1.8
0.9
3.12
0.5
1.3
1.5
0.9
3.25
0.5
1.4
1.5
0.8
3.31
0.6
1.6
1.8
1.6
3.42
1
CHX
OIL
NORMAL SALINE
CONTROL
GI
PI
ORGANOLEPTIC METHOD
ABC
BREATH SCORE


COMPARISON OF THE MEAN T2 VALUES OF THE VARIABLES
3.5
3
2.5
2
1.5
1
0.5
0
0.7
1
0.5
2.01
0.4
0.7
1
0.1
1.77
0.4
1.4
1.4
0.3
1.87
0.5
1.7
1.8
1.8
3.09
1
CHX
OIL
NORMAL SALINE
CONTROL
GI
PI
ORGANOLEPTIC METHOD
ABC
BREATH SCORE

RESULTS

STATISTICAL ANALYSIS

Mean plaque and gingival scores with mean objective organoleptic scores with breath analyzer were calculated. The anaerobic bacterial count (ABC) was calculated as colony forming units per ml (CFU / ml) and transformed into logarithamic base (base 10) . The group scores were calculated by taking mean of individual subject scores.

Kruskal wallis test and ANOVA test was used to determine if there was any statistical difference between and within the groups. The value of 0.05 was accepted as statistically significant. The analysis was performed using SPSS software.

RESULTS

The present randomized controlled study was conducted to compare the efficacy of chlorhexidine , Oil pulling and normal saline mouth rinses in reducing oral malorder and microbes causing it.

All the study participants (N = 40) completed the study . The mean age of the chlorhexidine group was 16.8 years , and for oil pulling it was 17.7 years , for normal saline group it was 17.6 years and for the control group it was 16.6 years . All groups had common brushing technique with similar paste and tooth brush.

Baseline values (Table 1) indicate that the subjects selected for the study were from a homogenous population and the mean values obtained from them were not statistically significant.

MEAN GINGIVAL AND PLAQUE INDEX SCORES (GI and PI)

The mean gingival score increased during the T1 of intervention (Table 2) in all the groups but it significantly got reduced in the chlorhexidine and oil pulling group on the T2 (Table 3) but remained increased in the normal saline and control group. There was statistically significant difference($p < 0.05$) in the mean gingival index before and after intervention in the chlorhexidine and oil pulling group during T1 and T2 of intervention.Similar results were seen for mean plaque index score within and among groups.(Tables 4,5,6)

Though the normal saline group was also statistically significant they were less effective than chlorhexidine and oil pulling group in reducing the gingival index and plaque index.

The control group results though statistically significant showed constant reduction in gingival and plaque index.

MEAN ORGANOLEPTIC SCORE AND BREATH ANALYZER SCORE

The mean organoleptic score was statistically significant among groups in both T1 (Table 2)and T2 (Table 3) of intervention. The organoleptic score improved in all the three groups (CHX : 1.9 to 0.5, Oil pulling: 1.6 to 0.4 , normal saline : 1.5 to 0.6) except the control group(1.2 to 1.8). The results were statistically significant because of the lesser efficacy of the control group compared to the other groups. The breath analyzer score also showed similar results.

ANAEROBIC BACTERIAL COLONY COUNT (ABC) [Table 8]

They were measured in colony forming units (CFU/ml). the samples were taken from the gingival crevicular fluid. The mean values were similar at the baseline among the four groups.But there was statistically significant difference ($p< 0.05$) among the groups in scores post intervention. The scores were statistically significant with chlorhexidine more efficient than the other groups on T1 of intervention (Table 4) . But on T2 of intervention oil pulling proved to be more efficient (Table 5) . Normal saline was also efficient but less efficient than oil pulling. (Table 3)

DISCUSSION

DISCUSSION

Orthodontic appliances facilitate plaque accumulation and gingivitis. Halitosis of oral origin is associated with microbial metabolism in the saliva, dental plaque and also depends on the amount of volatile sulfide-containing compounds released in the process. [60]

Tonzetich [58] found that fixed orthodontic therapy does not cause oral malodor, but there was a correlation between plaque, oral malodor and fixed appliance enhanced plaque accumulation.

In a study by Sökücü et al, it was shown that Orthodontic treatment affects PI, GI, and PPD causes halitosis and that the critical limit of halitos is reached at the end of 7 months.[49]

Evidence show that there is a shift in gingival microflora soon after banding with increases in anaerobic Prevotella and Bacteroides and T. denticola.[61]

Since regular brushing is compromised for the patients with fixed orthodontic appliances, adjunctive oral hygiene measures are required through out their treatment period.

Chlorhexidine has been reported to be the most effective antigingivitis and antiplaque agent[23]. It significantly reduces the volatile sulphur compounds (VSC) levels and the organoleptic scores. This ability is attributed to its strong antibacterial properties and better substantivity in the oral cavity.

Inspite of its superior qualities in maintaining the oral hygiene, patients restrain from using chlorhexidine for prolonged time due to its side effects like altered taste sensation, cost factor, staining of teeth, allergy, stomatitis. Chlorhexidine is also reported to cause reduction in natural resistance to viral infections [65].

Oil pulling is a traditional home remedy in southern India. It involves swishing of oil in mouth for systemic and oral remedies. The mechanisms responsible for its beneficial action is the saponification and emulsification process. The oil is also said to generate antioxidants[38]. These antioxidants damage the cell wall and kill the microbes. Sesame oil is used in this study for of its several known beneficial properties. It does not have the side effects like that of chlorhexidine and it has better palatability, easily availabe household product and is several times cost effective than chlorhexidine. The only disadvantage reported by patients was prolonged duration of procedure and more quantity of oil needed for procedure. More amount of motivation was needed for making the patients to accept oil pulling.[55]

Durai TA et al ., in his study found that Sesame oil is effective in reducing bacterial growth and adhesion. He also opined that toxins and bacteria from the body might be expelled through the tongue and gets trapped in the oil and removed from the body.[14]

Sesame oil is found to have three lignans:

1. Sesamin
2. Sesamolin
3. Sesaminol

These three lignans have antioxidant properties and they potentiate vitamin E action. Sesame oil has increased polyunsaturated fatty acids. They reduce the lipid peroxidation ther by reducing free radical injury to the tissues. The inhibit bacterial adhesion and plaque co-aggregation which may be attributed to the viscosity of oil.

The other possible mechanism of action might be saponification or soap making process. The soap making process is initiated when Sesame oil is acted upon by salivary alkali, like

bicarbonates. Soaps are good cleansing agents. This mechanism could have been the reason for the reduction of plaque and gingival scores.[38]

Fife B (2008) in his study found that oil pulling is not only good at preventing oral infections, but can also actively fight them . The oil pulls the bacteria, toxins, and pus out of the tissues, allowing the body to heal by itself.It is reported that inflammation and gingival bleeding reduce , periodontal status improves , and pain and sensitivity is considerably reduced .[16]

Oil pulling has been reported to have various oral health benefit like reducing Oral malodor , Preventing dental caries, reducing dryness of the throat and cracked lips and treats bleeding gums. Oil pulling benefits also include support and strengthen the body's immune system, which in turns helps the body be healthier and function better.[55]

Apart from oral health benefits it also reported to have general health benefits like reduction of thrombosi , eczema, intestinal infection, diabetes, bronchitis, asthma, headaches, chronic skin problems and stops the growth of malignant tumors.[55]

In this study, three oral mouthrinses were compared for their efficacy in reducing haliosis in orthodontic patients.

They were studied over a period of 20 days divided into three timelines :T0,T1,T2.

As Chlorhexidine is reported to cause staining of teeth when used for more than one month period( ), this study was restricted to be within the one months period.

The overall effectiveness of the interventions were compared using five parameters, namely:

1) Gingival index, 2) Plaque index, 3) Objective breath score using organoleptic method and 4) Objective breath score using Breath analyzer and 5) Anaerobic bacterial culture colony count.

In this study after placement of the brackets and bands, the PI and the GI scores started to increase in T1. These scores demonstrate that bonding of brackets and banding enhanced plaque retention. Similar findings was reported by Babacan et al,. [20] who stated that patients find it difficult to clean the tooth surfaces effectively around the attachments. Studies [20] have showed and that fixed appliances result in increased risks of caries and gingivitis. Immediately after bonding and banding, oral malodor directly increased parallel to the PI and GI indexes (tables 1,2). This was similar to observations made by Tonzetich showing a correlation between plaque and oral malodor[11]

There was a significant reduction in the GI and PI scores($p< 0.05$) in the chlorhexidine group and oil pulling group. Both the groups are found to be equally effective in reducing the gingival and plaque index scores. These results were similar to the results reported by Ashokan et al.[3]. The plaque score reduced in normal saline group but was not as much as in chlorhexidine or the oil group. The results of saline mouthrinse were same as that of the results obtained by Aravinth et al.[64]

In this study, in case of objective organoleptic scores [Table 9], oil pulling was found to be better performing than the other groups. Scores of breath analyser revealed that patients using Chlorhexidine, oil pulling and normal saline had reduction of halitosis and patients in control group had no change.

In reducing the anaerobic bacterial count[Table 8] , chlorhexidine was found to be more effective in short term but during the T2 of oil pulling was found to be more effective than the others.

The antioxidant and antimicrobial action of the sesame oil coud be attributed for reduction in bacterial count and therefore reduction in volatile sulphur compounds .

Ashokan et al., had reported that the reduction in bacterial colony count was not statistically significant. However in this study the values were statistically significant similar to the results by Poonam sood et al.,[38]

Chlorhexidine was effective when analysed for all the 5 parameters(Table 4). Its efficacy was less during the T1 of the study in gingival index, plaque index and it showed improvements in breath scores and reduction of anaerobic bacterial count(Table 2). The plaque index scores showed that chlorhexidine maintained the plaque levels at baseline level preventing an increase in plaque accumulation.

Findings at T2 proved that chlorhexidine was very effective with reference to gingival and plaque index scores and reducing the bacterial count. All the values were statistically significant(Table 3).

Oil pulling was also equally effective in all the five parameters and comparable to chlorhexidine(Table 5). The gingival index scores mild increased at T1 but decreased and at T2, thus showing improvement the gingival index scores. The plaque index scores showed that oil pulling maintained the plaque levels at baseline level preventing an increase in plaque accumulation.The reduction in breath scores and the bacterial count was more superior to the chlorhexidine group on the T2 (Table 3) . All the values were statistically significant.

The normal saline group was also effective to an extent in improving the breath scores and reducing the bacterial count but was not as effective as the chlorhexidine and oil pulling in

improving the gingival and plaque index scores (Table 6). The results of normal saline group was also statistically significant. In the study by Aravinth v et.al, [64], it was reported that salt water is effective against reducing dental plaque and the salivary oral microbial count. Their mechanism of action probably is due to the fact that at high concentration of salt solution, the solute concentration in the surrounding solution is greater than the cytoplasm of oral bacteria. Water moves out from cell by osmosis. Oral bacteria become dehydrated and eventually die.[64]

The control group that had performed tooth brushing alone with a placebo mouth rinse with paketed drinking water also showed reduction in breath scores and reduction in bacterial count. But they were less efficient compared to other three groups.

Inspite of all the four groups being effective in reducing the breath score and the anaerobic bacterial count, oil pulling was more effective in improving the breath score and anaerobic bacterial count than chlorhexidine and equally efficient as the chlorhexidine in improving the gingival health and preventing plaque accumulation.

These results show that oil pulling and Normal saline could be an effective alternative to chlorhexidine in maintaining the oral hygiene and oral health in patients undergoing fixed orthodontic treatment.

LIMITATIONS

1. Gender bias was not taken into account during this study. Hence it is not known if there would be difference in results according to gender
2. The subjects taken in this study belonged to the age group of 14 years to 20 years. The effect of the oral hygiene measures in other age groups need further research .
3. The effect of chlorhexidine/ oil / normal saline on surface properties of orthodontic appliances and hence their effect on biomechanics of orthodontics is not known, as it was not an objective of this study.
4. The study was done over a period of 20 days only. Hence effects of Oil pulling and Normal saline mouth rinse usage over a period of the complete duration of fixed orthoodntic treatment period needs to be studied.

SUMMARY AND CONCLUSION

SUMMARY

Maintainance of oral hygiene is important for an orthodontic patient because of the long term treatment process and the difficulty in maintaining the oral hygiene due the presence of intra oral appliances. Conventional tooth brushing is not sufficient for maintaining a perfect oral hygiene in fixed therapy patients. Hence, adjunct like a mouthwash which can easily clean araes which are not self cleansing and are out of reach for tooth brush bristles are prescribed.

The mouth washes available in market, like chlorhexidine have proven to be effeective in maintaining a good oral hygiene and have been widely prescribed. It is known that chlorhexidine mouth rinses have side effects, precluding their use in orthodontic patients. The prolonged use of mouthwashes alter the taste sensation and discolour the tooth. It becomes essential to find a mothwash which is easily accesible, palatable with no repored side effects on prolonged usage.

Hence this study was conducted to compare the efficiency of chlorhexidine, oil pulling , normal saline and the conventional brushing technique. These were compared using five parameters, gingival index, plaque index, breath anaysis by organoleptic method and breath analyzer and anaerobic microbial count in culture.

The data was subjected to Kruskal Wallis test and the ANOVA. The P value was set < 0.05 .

CONCLUSION

It was concluded from the study that ;

1) Chlorhexidine and oil pulling are efficient in maintaining the oral hygiene.

2) Gingivitis, oral microbial count and halitosis reduction was more significant when oil pulling was used when compared with chlorhexidine and normal saline.

3) Reduction in bacterial count was significan when normal saline was used . However, the gingival and plaque index scores and the breath scores were not significant when compared to others.

4) In order of effeciency, oil pulling was the most efficient , followed by chlorhexidine, normal saline and lastly by conventional brushing

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Annexure: AF 06/004/01.0

Informed Consent Form

"**Comparative study of efficiency of various oral hygiene measures on halitosis and its causative organisms in fixed orthodontic appliance therapy patients.**".

Participant ID No:

"I have read the foregoing information sheet given to me about the methods and procedures to be followed for the study, or it has been read to me. I have had the opportunity to ask questions about it and any questions I have asked have been answered to my satisfaction. I consent voluntarily to participate as a participant in this study and understand that I have the right to withdraw from the study at any time without in any way it affecting my further medical care."

Date		Name of the participant Signature/thumb impression of the participant

[The literate witness selected by the participant must sign the informed consent form. The witness should not have any relationship with the research team; If the participant doesn't want to disclose his / her participation details to others, in view of respecting the wishes of the participant, he / she can be allowed to waive from the witness procedure (This is applicable to literate participant ONLY). This should be documented by the study staff by getting signature from the prospective participant]

"I have witnessed the accurate reading of the consent form to the potential participant and the individual has had opportunity to ask questions. I confirm that the individual has given consent freely"

Date	Name of the witness	Signature of the witness
Date	Name of the interviewer	signature of interviewer

ஆராய்ச்சி ஒப்புதல் படிவம்

ஆராய்ச்சியின் தலைப்பு

பெயர் புறநோயாளி என்

வயது/பால் ஆராய்ச்சி சேர்க்கை என்

முகவரி

தொலைபேசி

நான் ---------- வயது ------ என்னுடைய சுய நினைவுடனும் மற்றும் முழு சுதந்திரத்துடனும் இந்த மருத்துவ ஆராய்ச்சியில் என்னை சேர்த்துக்கொள்ள ஒப்புதல் அளிக்கிறேன்.

கீழ்காண்படும் நிபந்தனைகளுக்கு நான் சம்மதிக்கிறேன்:

1. நான் இந்த ஆராய்ச்சியின் நோக்கம் மற்றும் செலயமுறைகள் பற்றி முழுமையாக தெரிவிக்கப்பட்டுள்ளேன் .
2. இந்த ஆராய்ச்சியில் என்னுடைய பற்களின் பிரதியை மருத்துவர்கள் எடுப்பார்கள் என்பதனையும் அறிவேன்.
3. என் உடல் நலம் பாதிக்க பட்டாலோ , அல்லது எதிர்பாராத வழக்கத்திற்கு மாறான நோய்க்குறிகள் தென்பற்றாலோ , அதற்கு சிகிச்சை பெற்றுக்கொள்ளுவதற்கும் முழு உரிமை உள்ளதாக அறிகிறேன்.
4. என் மருத்துவ குறிப்பேடுகளை இந்த ஆராய்ச்சியில் பயன் படுத்திக்கொள்ள சம்மதிக்கிறேன்
5. இந்த ஆராய்ச்சி மையமும் , ஆராய்ச்சியாளரும் என்னுடைய விபரங்கள் அனைத்தையும் ரகசியமாக வைப்பதாகவும் அறிகிறேன்.

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நோயாளியின் பெயர்	கையொப்பம்	தேதி
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ஆராய்ச்சியாளரின் பெயர்	கையொப்பம்	தேதி

ஆராய்ச்சி பற்றிய தகவல் படிவம்

ஆராய்ச்சி மேற்கொள்பவர் வழிநடத்துபவர்

மருத்துவர் அருண் நாராயணன் மருத்துவர் G.விமலா

ஆராய்ச்சியின் தலைப்பு

பல்சீரமைப்பு கருவிகள் பொருத்தப்பட்ட நோயாளிகளின் வாய் துர்நாற்றத்தின்மேல் பல்வேறு வாய் சுத்திகரிப்பு முறைகளின் ஆற்றல் மற்றும் நுண்ணுகிருமிகளின்மேல் அதன் ஆற்றலை ஓப்பீட்டு பார்க்கும் ஆராய்ச்சி

செய்முறை:

1. கீழ்கண்ட செயல்முறைகள் உங்களுக்கு செய்யப்படும்.
2. வாய் பரிசோதனை - உட்புறம்
3. உங்கள் வாயின் துர்நாற்றத்தை அளவிடுதல்
4. , உங்கள் வாயிலிருந்து உமிழ்நீர் படிவத்தின் மாதிரிகளை எடுப்பார்கள் பிறகு அதனை ஆராய்ச்சிக்கு உட்படுத்துவார்கள்.
5. உங்கள் வாய் சுத்தீகரிப்பு முறைகளில் சில மாற்றங்களை செய்வார்கள்

பங்கேற்பதினால் விளையும் நன்மைகள் : குறிப்பிடத்தக்கவை எதுவும் இல்லை

ரகசிய காப்பு: உங்களை பற்றிய குறிப்புக்கள் பிறை அறியாவண்ணம் ஆராய்ச்சி முடியும் வரை ரகசியமாக பாதுகாக்கப்படும்**.** அதை வெளிஅதுதும் நேரங்களில் எந்த தனி அடையாளங்களும் வெளிப்பட வாய்ப்பு இல்லை.

தன்னார்வ பங்கேற்பு: இந்த ஆராய்ச்சியில் பங்குபெறுவது தங்களின் தனிப்பட்ட முடிவு மற்றும் , இந்த ஆராய்ச்சியிலிருந்து நீங்கள் எப்போதுவேண்டுமானாலும் விளங்கிக்கொள்ளலாம் .

| --- | --- | --- |
| நோயாளியின் பெயர் | கையொப்பம் | தேதி |

ஆய்வு தொடர்பான கேள்விகளுக்கு: முதன்மை ஆராய்ச்சியாளர்: டாக்டர் அருண் நாராயணன் தொடர்பு விவரங்கள்: பி.ஜி. மாணவர், தமிழ்நாடு அரசு பல் மருத்துவ கல்லூரி மற்றும் மருத்துவமனை, சென்னை -600 003. தொலைபேசி எண்: 9894467625	பங்கேற்பாளரின் உரிமைகளைப் பற்றிய தொடர்பு விவரங்கள்: டாக்டர். சரவணன், MDS, PhD, தலைவர், நிறுவன நெறிமுறை குழு, தமிழ்நாடு அரசு பல் மருத்துவ கல்லூரி மற்றும் மருத்துவமனை, சென்னை -600 003.

Participant Information` Sheet

Title of the study : Comparative study of efficiency of various oral hygiene measures on halitosis and its causative organisms in fixed orthodontic appliance therapy patients.

Name of the research institution: Tamilnadu government dental College & hospital

Purpose and procedure of the study:

This study is done to find out the efficient and economic oral hygiene method to reduce halitosis during fixed orthodontic treatment

Procedure

Fixed orthodontic treatment for correction of the irregular teeth will be done

You will be instructed to use one of the following oral hygiene adjunctive methods during the study period of 2 months.

Risk of participation: .

1.Patients may experience discomfort / pain due to orthodontic appliance

2. patients may be allergic to any of the products used on them

Protection from risk

If pain / discomfort is complained about,required medication will be given.

If patients are found allergic ,adequate medical care will be given and they will be droped out from the study

Benefits of participation :

Correction of your irregular teeth will be done

1. **Confidentiality:**

The privacy of the patients in the research will be maintained throughout the study. In the event of any publication or presentation resulting from the research , no personally identifiable information will be shared.

2. Participant's rights:

Taking part in the study is voluntary. You are free to decide whether to participate in the study or to withdraw at any time. Your decision will not result in any loss of benefits to which you are otherwise entitled.

3. Compensation: NIL

Contacts:

For queries related to the study:

PRMARY INVESTIGATOR: DR.Arun Narayanan

CONTACT DETAILS: PG SECTION,DEPT OF ORTHODONTICS,
TAMILNADU GOVT DENTAL COLLEGE
& HOSPITAL,
FRAZER BRIDGE ,Chennai-600003.
PHONE NUMBER: 9894467625

For queries related to the rights as a study participant, please write to:

The Chairperson,
Dr. B. saravanan
TAMILNADU GOVT DENTAL COLLEGE & HOSPITAL,
FRAZER BRIDGE ,Chennai-600003.
PHONE NUMBER: 04425340441

TABLE 9

S.no	GINGIVAL INDEX			PLAQUE INDEX			ORGANOLEPTIC METHOD			**BREATH SCORE**		
	T1	**T2**	**T3**	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**
1	1	1	1	1	2	1	2	1	1	0 0 1	0 0 1	0 0 1
2	1	1	1	1	2	1	1	1	0	0 0 0	0 0 0	0 0 0
3	1	2	1	1	1	1	1	0	0	1 0 0	0 0 0	0 0 0
4	1	2	1	1	2	1	2	2	1	0 0 0	0 0 0	1 0 1
5	1	1	1	1	1	1	3	1	1	0 0 0	1 1 0	2 2 1
6	1	1	0	1	2	1	1	0	0	1 1 1	1 2 2	1 1 1
7	1	2	2	1	2	3	2	2	2	0 0 0	0 0 0	1 1 1
8	1	1	1	1	1	1	1	1	1	1 1 1	1 2 1	2 2 1
9	1	1	2	1	1	2	1	1	1	1 1 1	1 0 1	1 1 1
10	1	1	1	1	2	1	2	1	1	0 0 1	0 1 0	0 0 0
11	1	1	0	1	1	1	2	1	0	3 2 2	1 0 1	2 1 2
12	1	2	1	1	2	1	1	0	0	0 0 0	0 0 0	0 0 0
13	1	1	0	1	1	1	2	1	0	1 1 2	1 1 1	0 0 0
14	1	1	1	1	1	1	2	0	0	0 0 0	0 0 1	2 1 1
15	1	1	2	1	2	2	2	1	1	1 1 1	1 2 1	1 2 2
16	2	1	1	1	1	1	2	1	1	0 0 0	0 0 0	0 0 0
17	1	1	0	1	2	1	1	1	1	0 0 0	2 2 2	2 1 2
18	1	1	1	1	2	1	2	2	1	0 0 0	1 1 1	0 0 0
19	1	1	1	1	2	2	2	1	1	1 1 1	0 0 0	0 0 0
20	1	2	1	1	1	2	1	1	0	0 0 0	1 0 1	1 1 1
21	1	2	1	1	2	1	2	1	1	0 0 0	0 0 0	0 0 0
22	2	1	1	2	1	1	1	0	0	1 1 1	1 2 1	1 2 2
23	1	1	0	1	1	1	2	1	1	1 2 2	0 1 1	0 1 1
24	1	1	1	1	2	1	1	0	0	1 2 3	0 1 2	0 1 1
25	1	2	1	1	2	1	1	1	0	2 2 2	0 1 0	0 0 1
27	1	1	1	1	2	1	2	1	0	1 0 1	1 0 0	1 0 0
28	1	2	1	1	2	1	2	1	0	1 1 0	1 1 0	1 0 0
29	1	2	2	1	2	2	2	1	0	0 0 1	1 1 1	1 1 2
30	1	1	2	1	2	1	2	1	1	0 1 0	0 1 0	0 0 0
31	1	2	1	1	2	1	2	1	1	1 2 1	2 2 2	2 2 2
32	1	1	1	1	1	1	2	1	1	1 1 0	1 0 0	1 1 1
33	1	2	0	1	2	1	2	1	0	0 1 1	1 1 1	0 0 0
34	1	2	2	1	2	2	2	2	2	1 1 1	1 2 1	1 2 1
35	1	1	2	1	2	2	2	2	1	1 0 1	1 1 1	1 2 1
36	1	2	2	1	2	2	1	2	2	0 0 0	1 0 1	1 1 1
37	2	2	1	2	2	1	1	2	2	1 2 1	2 2 1	1 2 1
38	1	2	2	1	2	2	1	2	2	1 0 1	1 2 1	1 2 2
39	1	1	2	1	1	1	1	1	2	0 0 1	1 1 1	1 1 2
40	1	1	2	1	1	2	0	1	2	1 10	1 1 1	1 2 2
41	1	2	1	1	2	1	0	1	2	0 0 1	1 2 1	1 2 2

TABLE 9

TABLE 9

S.no	AGE	SEX	MICROORGANISMS					
1	14	FEMALE	P gingivalis	5.4 X 10^3	P intermedia	3.1x10^2	P gingivalis	1.6x10^2
2	16	FEMALE	P gingivalis	3.810^5	p gingivalis	2.6x10^3	p gingivalis	1.7x10^2
3	18	FEMALE	P gingivalis	4.7x10^4	p gingivalis	3.2x10^3	p gingivalis	1.6x10^2
4	18	FEMALE	P intermedia	4.3x10^4	P intermedia	3.6x10^3	p intermedis	1.6x10^2
5	17	FEMALE	P gingivalis	5.7x10^5	P gingivalis	3.6x10^3	P gingivalis	1.6x10^3
6	20	FEMALE	F nucleatum	4.8x10^3	F nucleatum	2.6x10^2	F nucleatum	4.9x10^2
7	14	MALE	T denticola	7.1x10^4	T denticola	5.6x10^3	T denticola	4.9x10^3
8	18	FEMALE	P gingivalis	4.8x10^4	P gingivalis	3.9x10^4	P gingivalis	2.1x10^3
9	19	FEMALE	T denticola	3.9x10^4	T denticola	2.6x10^3	T denticola	1.310^2
10	20	MALE	P gingivalis	3.9x10^5	P gingivalis	3.6x 10^3	P gingivalis	2.1x10^2
11	16	FEMALE	T denticola	5.6x10^4	T denticola	3.6x10^3	T denticola	1.2x10^2
12	14	FEMALE	T denticola	4.9x10^4	P gingivalis	3.1x10^3	T denticola	1.9x10^3
13	18	MALE	C nigar	4.6x10^4	C nigar	2.9x10^3	C nigar	1.0x10^2
14	19	MALE	P gingivalis	5.7x10^4	P gingivalis	3.9x10^2	P gingivalis	2.1x10^2
15	14	FEMALE	P intermedia	4.7x10^5	P intermedia	3.9x10^3	P intermedia	2.6x10^2
16	20	FEMALE	T denticola	4.9x10^4	T denticola	3.6x10^3	T denticola	2.1x10^3
17	19	FEMALE	F nucleatum	6.1x10^4	F nucleatum	5.2x10^3	F nucleatum	1.1x10^2
18	14	FEMALE	P gingivalis	4.6x10^4	P gingivalis	2.1x10^3	P gingivalis	1.0x10^2
19	16	FEMALE	P gingivalis	3.1x10^4	P gingivalis	2.1x10^3	P gingivalis	1.9x10^2
20	17	MALE	P gingivalis	4.2x 10^3	P gingivalis	3.9x10^3	P gingivalis	2.9x10^3
21	15	FEMALE	F nucleatum	3.9x10^4	F nucleatum	2.1x10^2	F nucleatum	1.6x10^2
22	18	FEMALE	P gingivalis	4.1x10^4	P gingivalis	3.9x10^2	P gingivalis	1.1x10^2
23	16	FEMALE	P intermedia	5.6x10^4	P intermedia	3.6x10^2	P intermedia	3.1x10^2
24	17	FEMALE	P gingivalis	4.6 x10^3	P gingivalis	3.2x10^2	P gingivalis	1.1x10^2
25	18	FEMALE	P gingivalis	3.2x10^4	P gingivalis	2.6x10^4	P gingivalis	2.2x10^3
27	17	MALE	T denticola	6.1x10^5	T denticola	4.2x 10^3	T denticola	3.9x10^2
28	18	MALE	P gingivalis	4.6x10^5	P gingivalis	2.1x10^3	P gingivalis	1.1x10^2
29	19	MALE	P intermedia	5.2x10^5	P intermedia	3.8x10^3	P intermedia	2.1x10^2
30	18	FEMALE	P gingivalis	3.2x10^5	P gingivalis	2.3x10^3	P gingivalis	1.0x10^2
31	19	FEMALE	T denticola	4.8x10^4	T denticola	3.6x10^3	T denticola	2.1x10^2
32	20	FEMALE	T denticola	3.6x10^5	T denticola	2.1x10^3	T denticola	1.6x10^2
33	15	MALE	P intermedia	4.6x10^4	P intermedia	2.6x10^3	P intermedia	1.2x10^2
34	18	FEMALE	P gingivalis	3.6x10^4	P gingivalis	2.3x10^4	P gingivalis	2.4x10^4
35	15	MALE	P gingivalis	5.6x10^5	P gingivalis	4.3x10^3	P gingivalis	3.9x10^3
36	18	FEMALE	T denticola	3.6x10^4	T denticola	3.1x10^4	T denticola	3.6x10^3
37	18	MALE	P gingivalis	5.6x 10^3	P gingivalis	4.3x 10^3	P gingivalis	3.1x10^2
38	17	MALE	P gingivalis	4.2x10^4	P gingivalis	3.9x10^3	P gingivalis	2.6x10^3
39	18	FEMALE	P gingivalis	1.2 x10^3	P gingivalis	2.1x10^2	P gingivalis	3.0x10^2
40	17	FEMALE	P intermedia	3.6x 10^3	P intermedia	2.1x10^3	P intermedia	1.9x10^3
41	15	MALE	P gingivalis	4.9x10^5	P gingivalis	4.1x10^5	P gingivalis	3.6x10^4